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METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

Underlying Principles of the Limestone Replacement Deposits of the Mexican Province-I, *by Basil Prescott*

Marble pillars, sculptured by channeling machines and wedges, support the roof of the underground quarry at West Rutland, Vermont, where the Vermont Marble Company is operating. See pages 244 and 245

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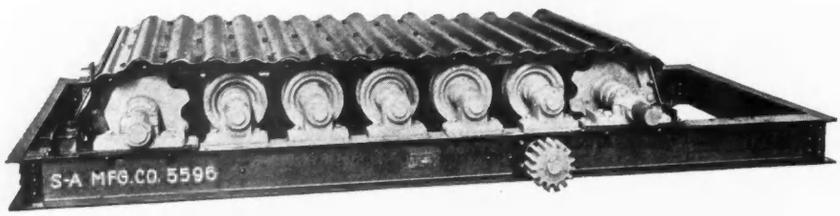

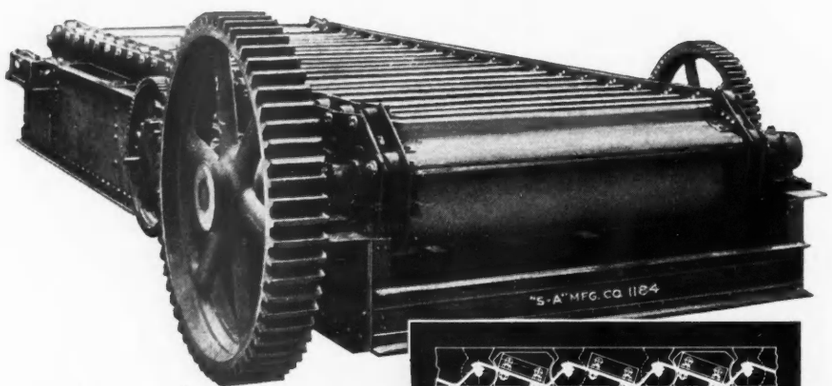

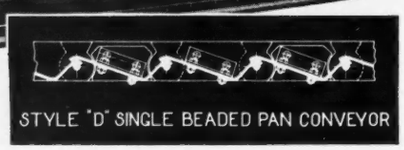
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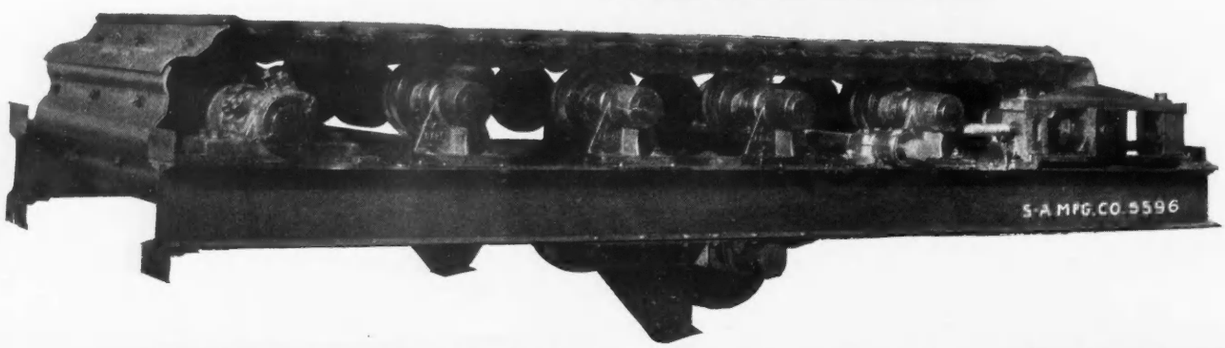

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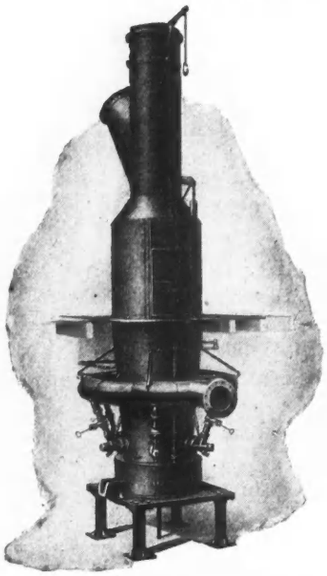

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

Volume 122 New York, August 14, 1926 *Number* 7

The Four-Year Business Cycle

WHEN THE INDUSTRIES of a country are active and times are generally considered prosperous, the amount of raw material required is large, so the mining industries are busy, and mining is generally profitable. Security prices are then well above normal, and those at the helm of state can, if they feel so inclined, point with pride to a successful administration. Economists have taught the public that such eras of good times proceed in cycles, so when conditions get too rosy and prosperity has persisted for a year or two, the wiseacres begin taking favorable company reports and bullish Wall Street stories with a grain of salt and perhaps quietly unload their General Motors stock at 150 or 160. They are anticipating a reaction on general principles, but as a matter of fact it is special conditions and not general principles that govern the action of the stock market as well as the activity of the mining and other industries, and the prosperity of the farmer, fisherman, and lumberman. A study just completed, or perhaps still going on, by the National Bureau of Economic Research reveals the fact that from 1796 to 1923 there were thirty-two business cycles in the United States, the average length of which, simple arithmetic reveals, was exactly four years. So if average conditions prevail all around, the high tide of good times should be followed two years later by the ebb tide of depression.

It has been said that there is no average man, or mine, or anything else, including business cycles. This is not altogether true, for it is probable that one or more of the thirty-two cycles mentioned did last exactly four years, but the chances are much against Mr. Average asserting himself, he is so vastly outnumbered by his inferiors and his superiors. One of the cycles, for example, lasted only one year, whereas another lasted as long as nine years, so any one who predicts the future entirely by what has happened in the past, without due regard to present and future affecting conditions, is likely to find himself discredited.

Last spring there was a pessimistic feeling regarding the 1926 average price of lead. The St. Louis price had gradually advanced from 4.4c. in 1921 to 5.5 in 1922, 7.1 in 1923, 8.0 in 1924, and to 8.8c. in 1925, and it was thought that a reaction was due. But the price now is fully up to last year's average, and certainly no present weakness in the situation is apparent. Industrial conditions now are generally conceded to be likely to continue excellent throughout the remainder of the year, and there is no reason why metal prices should not continue as high in the next few months as they are now, or even improve. And 1927 may be equally as good. Experience shows that business does not proceed according to any definite time schedule. Reactions are never "due."

A Spectacular Blast

THOUGH blasting and explosives are every-day matters with the average mining engineer, few have had the opportunity to view an explosion of the magnitude of that which recently wrecked the naval ammunition depot at Lake Denmark, New Jersey. Less than half a mile from the magazines that blew up is the plant of the Mount Hope mine of the Replogle Steel Co. Its superintendent, R. R. Van Valkenburgh, who witnessed from a good vantage point the last of the three major explosions, says that the flash of the shot did not seem like lesser ones that he had seen underground, but rather like a huge sphere of livid red that rose above the hill. This then burst into a shower of fire, from which emanated what appeared to be a solid curtain of gray fog, which advanced toward him over the cleared field, moving apparently at the rate of a racing motor car. So comparatively leisurely was its approach and so fascinating was the spectacle that he made no effort to seek shelter, and as a result was knocked down by the force of the concussion. This curtain, says Mr. Van Valkenburgh, must have been the compression of the humid atmosphere, because the smoke from the explosion was dissipated toward another quarter.

This blast alone tore a hole in the ground about 35 ft. deep and 200 by 100 ft. in horizontal dimensions. Miners underground felt its force in varying degrees, but none thought that more than a fall of ground in some of the old workings had occurred. Each building of the mine plant sustained some minor damage, but no machinery was injured. Those who live in mining camps and who have wondered at times what would happen if one of the local magazines "let go," may here find satisfaction for their curiosity. The explosion might not be so annihilating after all.

Use of an Objective

ONE OF OUR CORRESPONDENTS, writing particularly of Institutes, points out that they exist, so far as most of the members are concerned, without conscious or evident objective. They are created with a purpose, clear enough in the minds of the founders, but the machinery having been set into motion, there is a tendency for it to run around automatically—meetings, "papers," banquets—without any definite port of destination. This our correspondent thinks is unfortunate.

The condition indicated is apt to be true of most institutions and of most men. In a way a man is an institution within himself. Set going, he may drift along as environment and chance determine; or he may set himself a definite end to accomplish. Both methods may lead to prominence or even greatness; both meth-

ods may lead to disappointments and regrets. There are many wayside inns in life, where the casual and carefree traveler may drop in and find pleasant sojourning; there are many glorious mountain vistas, which the holder of a vision may or may not attain after a forced and Spartan march. Some, striving for a certain great end in view, happen upon a totally different but satisfactory camping place; there are many men of prominence who could give instances. President Grant and Vice-president Thomas Marshall come to mind among the drifters, who nevertheless drifted into appropriate surroundings. But we can hardly think of Edison or of Roosevelt as guided by chance: they followed the star clear to the horizon's end.

There is something to be said, finally, for institutions that do not move forward definitely toward new objectives, as the older ones are attained and grow stale: in favor of individuals who are pleased with what the morning and the night bring them. Nevertheless, there would be no growth, no spectacular advance or astounding failure, were it not for those institutions and men who explore eagerly the wilderness which lies beyond the limits of the encampment. Take your choice. Many a man takes one in his heart, and follows the other. Content comes only from harmony between ideal and activity. The drifter who does it gallantly has his place in story and in song. As Rathbun puts it

"Three things in my heart have place:
A sunset sky, a wilderness
And a sunny smile on a stranger's face,
Telling a noble carelessness
In life and death, love and disgrace."

The Absentee Mine Owner

MUCH HAS BEEN SAID in Western papers regarding the absentee mine owner—the mine owner who lives in New York, Boston, or some other Eastern city and conducts mining operations in Arizona, Oklahoma, Idaho or other states in the Far West.

Figures collected recently by the Idaho Mining Association indicate that he is not such a detriment to the state after all. Ravenel Macbeth, secretary of the association, makes the statement that eight million dollars is the amount of money that enters Idaho annually to be spent in mining operations. This comes from absentee owners. Mr. Macbeth does not say how much domestic money is similarly spent in Idaho. Evidently it is not much, if the few major companies are eliminated.

Idaho is the only state that has systematically collected data showing the actual amount of money spent by non-producing development companies and producing non-dividend paying mines. The returns for five counties for the year 1925 show that four million dollars was spent on the above class of mines, of which more than three million dollars was spent in Shoshone County alone in a single year. Of the four million dollars expended, $2,422,000, or slightly over 60 per cent, went directly to labor, the remainder being spent on supplies, equipment, and freight on ore and bullion shipments. The amount spent by the producing non-dividend paying mines should be credited with ore returns in order to get at the net outside capital coming into the state. Development on such mines as the Hecla or Bunker Hill & Sullivan properties is not included in the figures cited above. The total metal mine production of the state in 1925 was $32,941,930, or four times the amount of foreign money entering the state.

Shut outside capital out of the Rocky Mountain states and they would soon revert to primeval wilderness and there remain. New orebodies would not be discovered; prospects would not be developed, and many mines that are now operating would soon cease to function. Of the amount that labor obtains practically all is spent in the state for food, clothing, and rent. It creates a market for local produce and builds up business centers, all of which in turn call for schools, roads, and other improvements. Last but not least, foreign money thus expended develops new mines and creates actual wealth which would long remain latent without outside aid.

Production and Dependence

WHAT IS CALLED the most powerful machine on earth was mounted on its massive base the other day—a 60,000-kw. turbine generator capable of generating 80,000 hp., which will be put in service this fall. Contemplation of this colossus, its application and construction, furnishes food for thought. Huge as it is, it is only one of nine great units to be installed in one of the stations of a large light and power company. The amount of power to be applied to industry that it alone can produce is sufficient to operate thirty-one Panama Canals, pull forty-seven Twentieth Century trains, or light 300,000 six-room homes, it is estimated. It is to the great productivity of the United States that the prosperity of the country and its workingmen is ascribed, and the secret of that productivity is cheap and abundant electric power, as the British Trade Union Mission to the United States recently found. The investigators discovered, the Mission has reported, that employers here believe in putting from 3½ to 4 hp. of energy at the elbow of every workman.

In considering how this generator is built, the thought is led in a different direction by certain details of construction—details that remind afresh how dependent the United States really is, instead of self-sufficient. One hundred and eleven materials, carried in all a quarter of a million miles on sea and land, by elephant, camel, peon, ship, and train, entered into the machine's construction. Silk brought from China, rubber from Ceylon, whiting from France, together with asbestos from Quebec, are among the materials that make the coverings for the wires. Copal nubs from the Philippines, kauri chips from Singapore, raw umber from Turkey, linseed oil from the Argentine, wool oil from China enter into the varnish with which the coils are covered. Tin from the East Indies mingle with Chinese antimony and domestic copper to make bearing metals. Shellac from India coats the terminals. So the machine stands as a monument not only of American achievement but of American dependence on the other countries of the earth. In most of our industries similar monuments may be found.

The Chilean Nitrate Producers' Problem

MONOPOLIES ARE TREACHEROUS THINGS. The good old law of supply and demand, unlike some of the more modern laws, is difficult to subvert. In the fiscal year ended on June 30 last, the Chilean nitrate producers did not fare so well as they expected, though production, 2,569,000 long tons, was

greater than for several years. Stocks, however, increased by close to half a million tons, for substitutes made increasing inroads into the business. As a result, prices have recently shown a declining tendency, and dividends have been cut. In certain sections of the world, especially in Europe, consumption of nitrogenous fertilizers has not been high, chiefly owing to the fall in exchange rates and to the low prices received for the products that are normally fertilized, though the total consumption of all countries increased. Synthetic nitrogen products are coming more and more into competition with those made from the natural *caliche;* Germany, for instance, formerly a large consumer of Chilean nitrate, is now in position to supply her domestic needs from her own factories and is looking about for an export market. In the United States and other countries also, artificial compounds of nitrogen are being made in increasing amount, and last year's production of about 580,000 long tons of nitrogen content is expected to be increased by 25 per cent in the coming year.

Some criticism has been leveled at the Chilean producers for maintaining high prices in the face of this competition, but, judged by pre-war standards, present prices certainly cannot be considered high. In 1913, the average price was about $2.40 per hundred pounds and now it is $2.33 to $2.40; at one time during the war the price rose above $5. But evidently some more aggressive selling policy will have to be undertaken to prevent the early decline of this "monopoly" even in the face of an increasing world demand for its product. Costs must be reduced through a better handling of labor and improvements in process, and Chilean taxes and duties must not be so excessive as seriously to injure the oviducts of the heretofore productive goose.

Controlling Electrical Machinery

"MAKING MACHINERY SWEAT instead of the workman," said Secretary Hoover last spring, "has swelled productivity about 170 per cent within the last quarter of a century, while the number of people in industry has increased only 65 per cent." This in pointing out that through labor-saving machinery the United States is making great strides in national efficiency. In making machinery sweat it is electricity that is being increasingly applied. At the start motors were simply substituted for the large steam power units, and the power was distributed by belts as before. Today, the individual motor for each machine is the vogue—for tables, flotation machines, ball mills, and other equipment. The contrast between the old and the new in some large mills is marked in this respect. The vanner floors of the Magna plant in Utah fifteen years ago were a maze of belts, each vanner connected by a long driving belt to the shafting overhead and all driven on each unit by a single motor. Today this has given way to flotation machines, each with its separate motor, making for simpler and more efficient operation.

The advantage of electric power lies in the effectiveness with which it is used, and this in turn depends on its control. This can be effected with ease and accuracy, a fact which makes efficient and precise automatic operation possible, when needed. It is by correct motor control that the full advantage of the flexibility of electricity may be had and maximum economy be maintained. Much time and thought have been devoted by engineers to the subject of control, until today the proper apparatus may be had for thousands of different applications.

Mechanicalization of Malayan Tin Mines

AN AMBITIOUS PROJECT is being fostered by the Federated Malay States to harness the Perak River and generate 27,000 kilowatts of electric power, the major portion of which will be used in the tin-mining industry. The dam will be 65 ft. high and 640 ft. long, the construction of which with the hydro-electric equipment will cost £2,320,000 and be completed within three years. Hydro-electric power will mean a saving of at least 30 per cent of the present power cost, and where hand labor is employed, as in the case of mines operated by Chinese, the saving will be even greater.

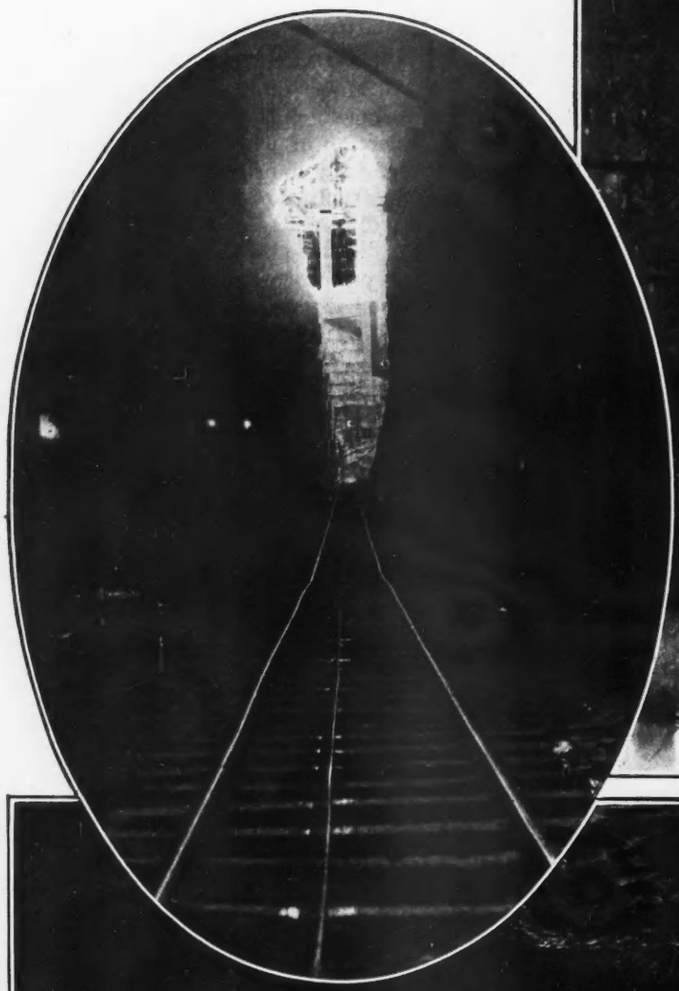
The *Mining Journal* (London) says: "In boldly adapting the hydro-electric scheme they have displayed both initiative and vision, realizing that power and consequently cheap production means increased dividends upon mines already operating, longer life to each individual property, increased areas under working, and, in mass, a long extension of the Malayan tin mining industry." The specifications under which construction contracts are to be let state that "all plant machinery and equipment required shall be entirely of British manufacture."

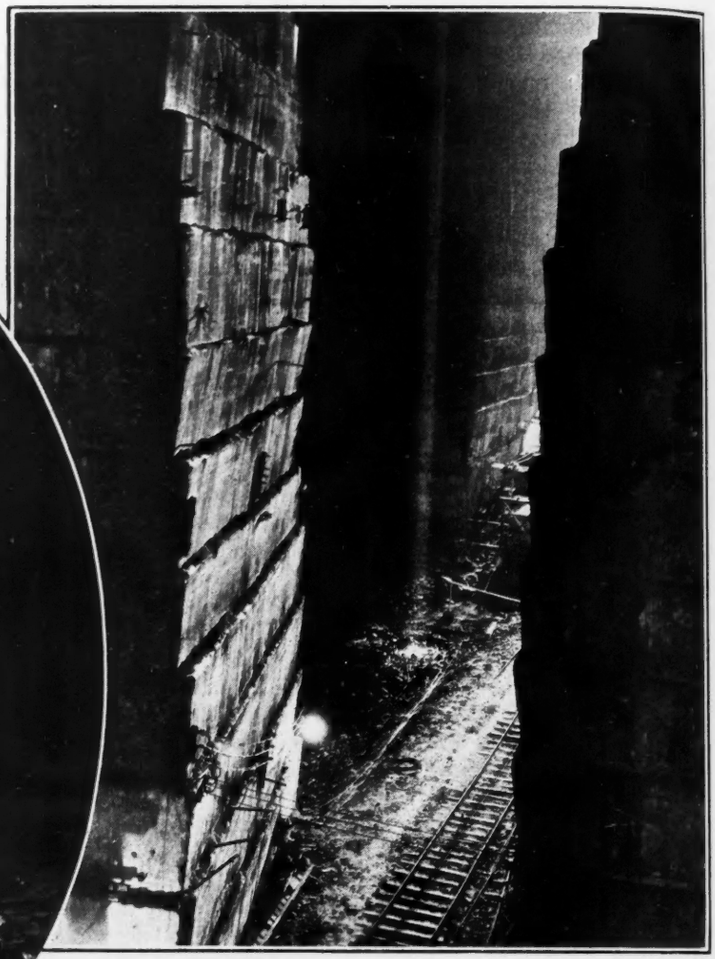
Twenty-five years ago the Malayan tin mines were almost entirely in the hands of Chinese and operated by hand labor. About ten years later it was beginning to be realized that production could not be maintained without the use of mechanical equipment. Then came the Great War, which delayed installation of modern machinery. Success in dredging and sluicing in recent years has been so marked that every effort has been directed toward improvements in bulk handling and economical working. Such steps as these are the means by which ore reserves may be made to yield to a lower economic limit and prolong the coming of the time when there shall be a dearth of metals so essential to present-day civilization.

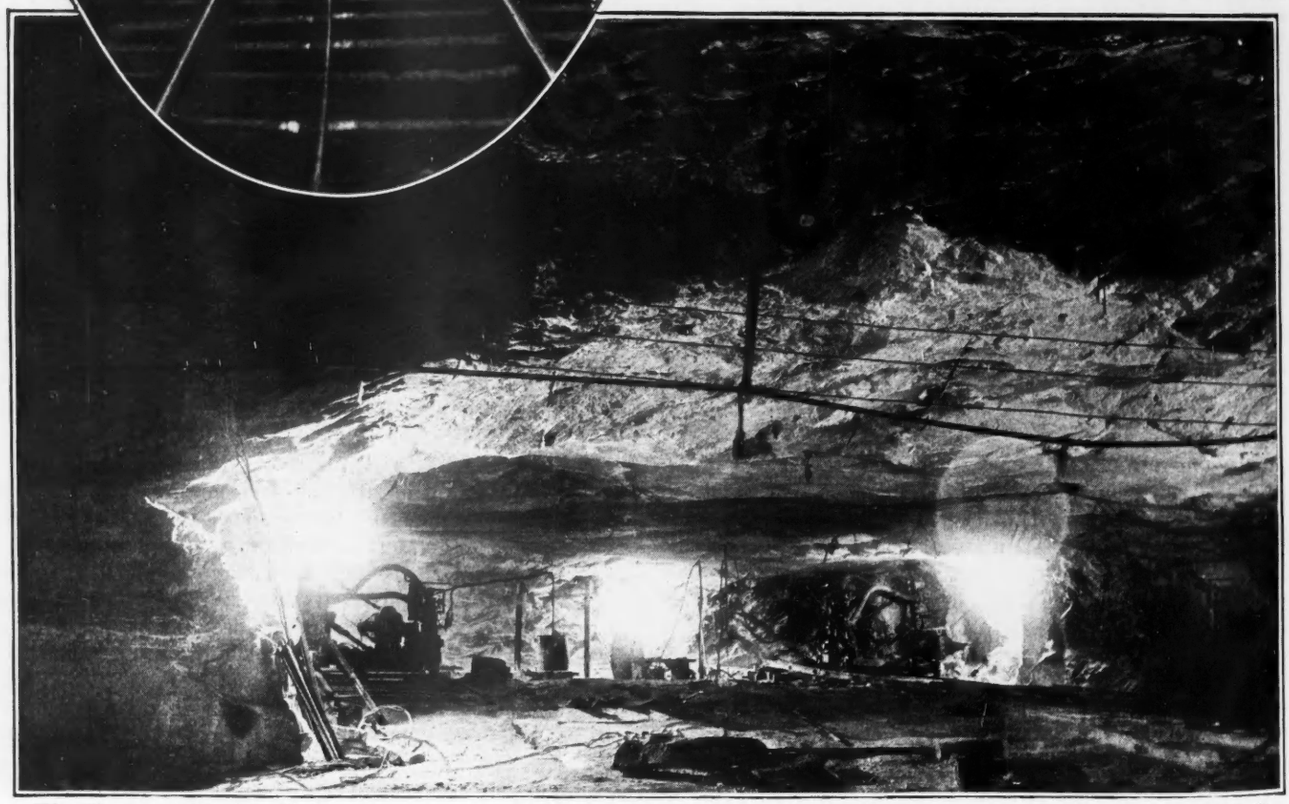
Mills Galore

WERE IT POSSIBLE to transport the Joplin-Miami zinc and lead district to the outskirts of Los Angeles it is likely that more would be heard of it. It lacks a booster, though perhaps this is something to its own advantage. That it produces most of the country's slab zinc has been pointed out in these pages more than once. Likewise that its many mines are situated in a fertile, well-watered, and habitable region. Its methods are at times unique but well-adapted to conditions. Its mills are numerous; so numerous, in fact, that the number excites attention. At the last count, made only recently, there were no less than 251 concentrators, of which 155 were active. This is enough to give any district a landscape, even if it had none before. The Joplin region has a skyline all its own, with its "derricks," elevators, and chat piles. It is in the number of its mills that it seems the most remarkable. No other mining region on earth is so well provided. A few less might help the price of concentrates.

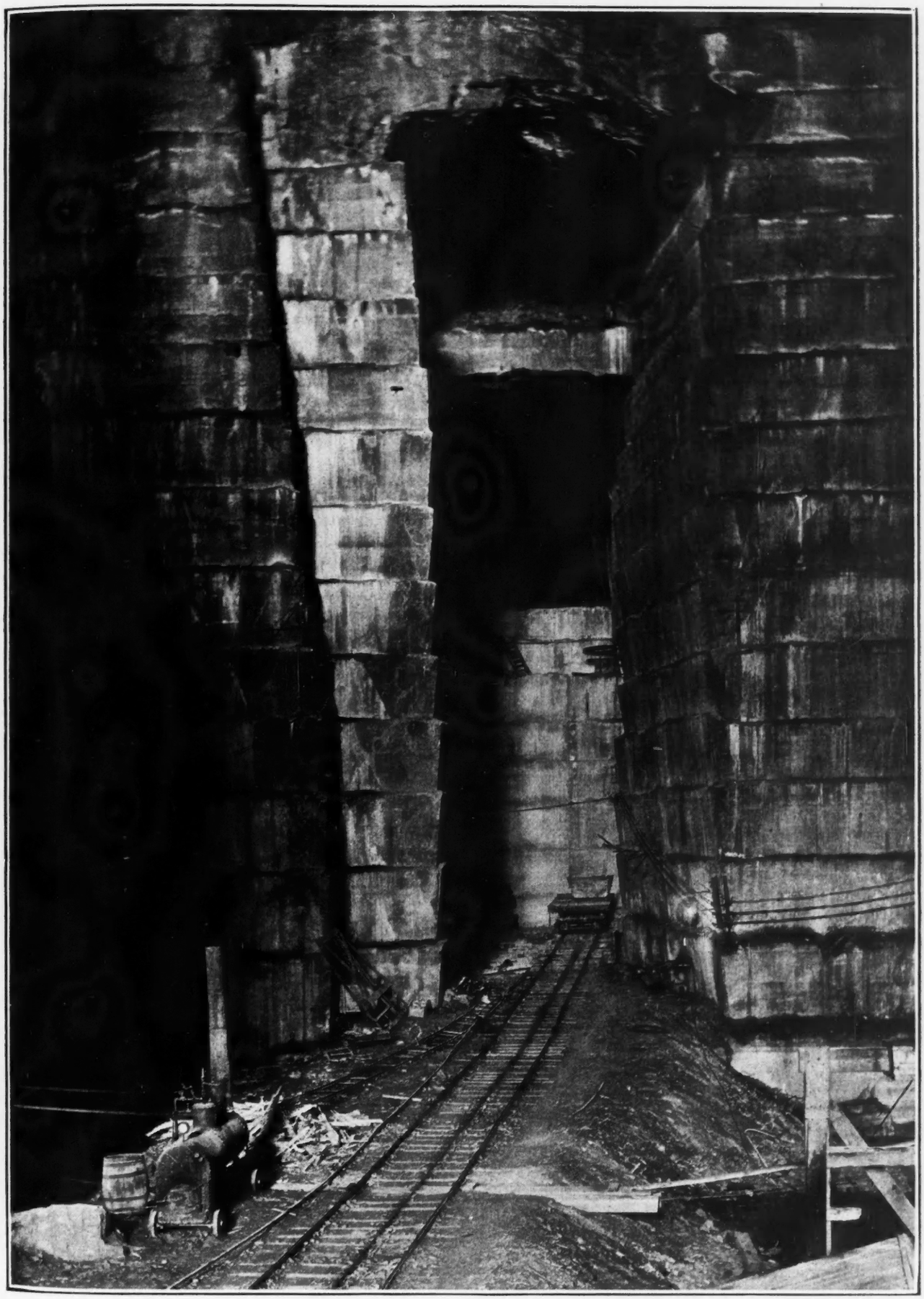
West Rutland's Unique Underground Quarry







The Vermont Marble Co.'s quarry is worked in the open by the usual methods until at a depth of about 200 ft. the almost vertical deposit, 50 ft. thick, turns at right angles and goes into the hill. In the oval—Where surface and underground meet. At right—Some of the pillars (see front cover). Bottom—The operation of quarrying is begun by driving a tunnel in the usual manner. Then the channeling machines, shown here, continue the work, and the marble blocks are removed by an underhand method.



A remarkable view of the underground quarry. Here, the preliminary tunnel, from which the channeling machines worked downward, is seen near the top of the page.

The Underlying Principles of the Limestone Replacement Deposits of the Mexican Province—I

By Basil Prescott

Consulting Geologist, The American Metal Co., Ltd.; Cia. Minera de Peñoles, S. A., and Their Subsidiaries, 513 Mills Building, El Paso, Tex.

LIMESTONE REPLACEMENT DEPOSITS are exceptionally numerous and well developed in the Mexican province. Worked, many of them, since the time of the Spaniards, they still continue to produce the bulk of the smelting tonnage of Mexico, and during the present century have been more productive than at any period of their history. Nevertheless, the bonanza days are practically over, and although occasionally a new deposit may be brought in that will flourish temporarily, on the whole continued production must result from detailed study, carefully laid out plans, and quite reckless development campaigns. During the period in which unworked orebodies were numerous and could be found either outcropping on the surface or in tunnels and shallow workings there was no great necessity for a correct conception of the underlying principles governing the localization and distribution of the mineralization, but as it becomes increasingly difficult to locate new orebodies, and the required outlay in capital and time grows heavier, it is essential that the objective be attained with maximum efficiency.

Some fifteen years ago certain conclusions were reached as to the mode of formation of these ore deposits, which conclusions, though perhaps not new, were certainly not in accord with the popular or accepted ideas, and were original in so far as they were the result of experience and observation rather than the study and investigation of the records of others. At first it was thought that these conclusions might have but local application—for example, might govern only in the district where promulgated—but after fifteen years of almost continuous investigation of such deposits, assisted at times by many careful and conscientious geologists, certain fundamental laws seem to have been developed, which hold in all cases in the Mexican province. It may be stated that all or part of these laws are accepted and used by at least a majority of the operators and examining engineers in this province, and, further, that the search is now for authentic, well-developed examples of exceptions, since supporting examples and evidence are constantly met.

It is not the intention to attempt a world-wide application of these principles to replacement deposits, though they could undoubtedly be readily extended to cover the Western United States; nor is it the intention to enter into the controversy as to the origin of the Mississippi Valley lead and zinc mines, inacceptable as the present popular hypotheses are to the average Cordilleran geologist; but simply to show, if possible, wherein the ideas are essentially and basically different from the commonly held theories, that the formulation and acceptance of these laws is forced on the Mexican observer and operator, and that their application has resulted in practical benefit.

It is commonly stated that these limestone-replacement orebodies occur in caves in the limestone joined by narrow, almost microscopic, connections, which, if followed, lead from one orebody to another, and that the orebodies are enlargements of these fissures, usually at the junctions of two or more of them. This is an erroneous picture, at least in so far as the Mexican province is concerned, and abets and lends support to the abandonment of innumerable orebodies that under some other conception of conditions might have been followed and kept productive.

The day has passed when the despairing engineer or geologist might conclude his unfruitful study of a limestone replacement deposit with the words "The ore occurs like plums in a pudding," and then expect to have his conclusions received as very enlightening and quite neatly summarized, although but a few years ago the phrase was almost a byword with the profession and is still occasionally encountered. No serious damage is done by such statements, for the experienced operator carefully files the report and continues to follow his ore, or its indications; but those unfamiliar with ore deposits of this type, who are suddenly forced by circumstances to take their eccentricities under consideration, are entitled to something more definite and helpful.

The following discussion of limestone-replacement deposits is limited to those occurrences in which igneous rocks are entirely lacking in the area and horizons exploited, or to those in which the exposed igneous rocks occur in minor quantities, either post-mineral or at least without important genetic relation to ore deposition. It is admitted that this eliminates several highly productive and interesting districts where undoubted replacement orebodies are found along or near igneous contacts; but though the application of the underlying principles involved can usually be made, nevertheless the presence of igneous rock introduces factors that confuse the issue and complicate the discussion.

The elimination of the districts in which igneous rocks occur in the area and on the horizons exploited cuts down the range and variation of the predominating metallic content of the ores, as, for example, the high temperature conditions under which most copper deposits occur are only occasionally found free from associated igneous rocks. In the Mexican province, well-developed ore deposits, within the limits defined, are almost all confined to silver-lead-zinc occurrences.

THE UNDERLYING PRINCIPLES

The following basic laws are those that experience has shown to be the only ones that satisfy the conditions present in all occurrences in this province. In the early years of the study of this problem these basic principles were more numerous and varied; but time, aided by extensive development in many mines, has eliminated much of the obvious as unessential, has proven over and over again that those factors, which in one district were apparently the fundamental guiding principles, might either be absent in another or be

present without serious effect on the occurrence or distribution of the ore. It cannot be overemphasized that in no one district can the underlying laws be deduced; only by comparison and cancellation do the common factors result, and these, as might be expected, are simple and few in number:

1. The orebodies are continuous from the point of entrance into the favorable limestones at depth, to the surface, to the point of egress from the favorable beds, or until they gradually become extremely attenuated.

2. The area of the cross-section of the orebody at any point will not be greater than a small multiple of the area of the normal cross-section near by, nor smaller than a large fraction of that normal cross-section.

3. The progress of the mineralizer is nearly always upward from its source.

4. The analysis of each orebody is distinctive and, broadly considered, invariable.

5. The orebodies are essentially chimneys or pipes, whether standing vertically and obviously fulfilling the accepted idea of a chimney or pipe, whether inclined at any angle, or even lying horizontally; and, as in pipes, the ore deposited in the portions farthest from the source has passed through and inside the walls of the orebody nearer the source.

6. Between the point at which the deposits start in depth and the finishing point at the surface, or where the mineralizer enters unfavorable overlying formations, the course of a single orebody will be controlled by any one, any combination, or all of the following factors: (a) selective action of certain limestones, (b) variation in composition of the sedimentaries, (c) structure of the limestone, (d) posture of the beds, (e) pre-mineral fissures.

7. The first favorable limestone encountered by the ascending mineralizer is often by far the most productive, though, under certain conditions, the last favorable limestone also may be unusually productive.

Corollary to 1. An orebody has not been followed to its commercial limits away from its source if, where last known, it is still in favorable limestone and has a strong cross-section; its end will be approached through a gradual diminution in size and strength.

Corollary to 5. The rôle the fissures play in these deposits has been greatly overemphasized. In most cases, though not in all, they have a very minor part in the primary deposition.

In the Mexican province we are dealing with a geologic column that naturally varies considerably over the great area involved. The scope of this paper does not permit a discussion of these variations, nor would such be entirely pertinent; but, that a conception of the conditions may be had, the accompanying generalized column is given and will be found to satisfy a great number of cases. As economic geologists and metal miners are more interested in the lithologic variations than in the paleontologic, the subdivisions are on that basis and do not always correspond to the more accurate determinations based on fossils and dealing with geologic time. No great difficulty is experienced in correlating sections that occur along a north-northwest-south-southeast line, as variations are comparatively slight and progressive; but the correlation of the sequence and column of a district lying to the east with one to the west is unsatisfactory and uncertain.

The term "favorable bed" or "horizon" is being used quite freely, and to avoid a long and intricate discussion of the physical or chemical properties and the exact factors that may render a bed favorable, such will be defined only as a bed in which ore occurs in unusual quantities, or one, identical in all characteristics, which, through some accident of location, was not subjected to mineralization.

Ore occurs, in exceptional instances, in the Blue Limestone; the overlying Lower Fossil horizon is remarkably prolific and favorable (Fig. 1); while the beds between this and the Upper Bufa are somewhat

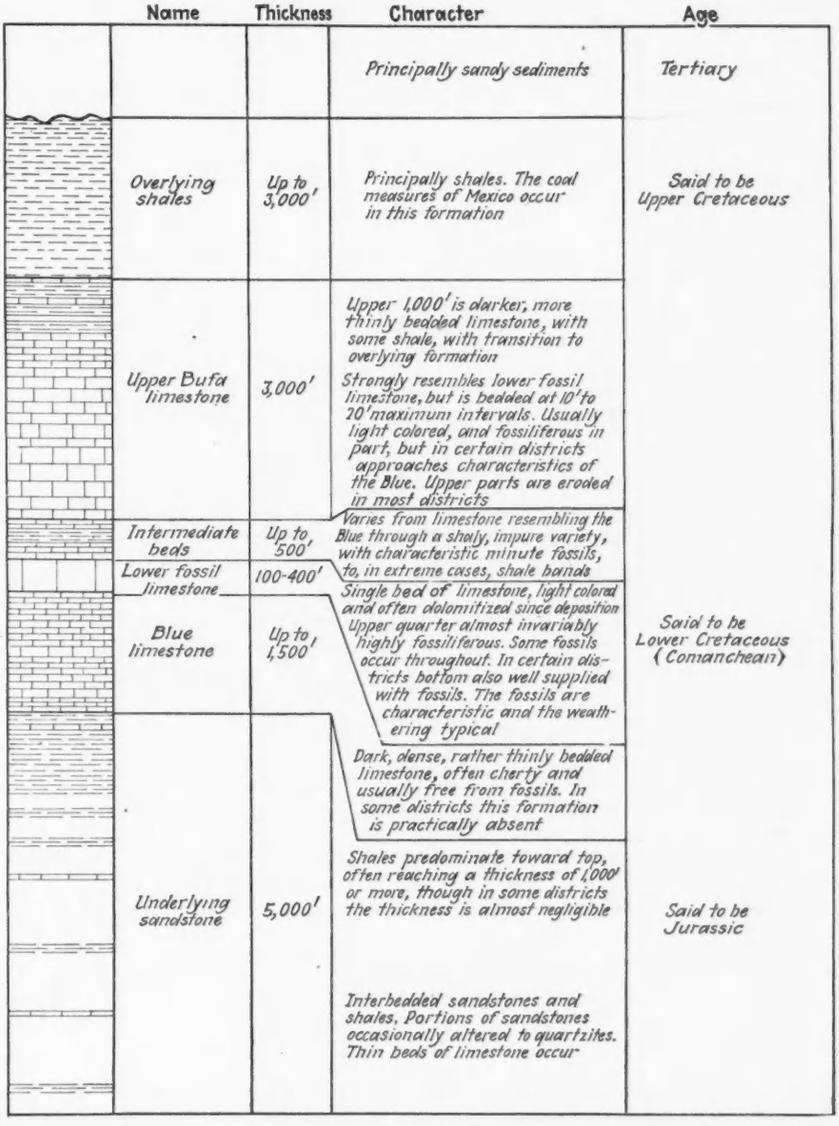

Name
Thickness
Character
Age
Principally sandy sediments
Tertiary
Overlying shales
Up to 3,000'
Principally shales. The coal measures of Mexico occur in this formation
Said to be Upper Cretaceous
Upper Bufa limestone
3,000'
Upper 1,000' is darker, more thinly bedded limestone, with some shale, with transition to overlying formation
Strongly resembles lower fossil limestone, but is bedded at 10' to 20' maximum intervals. Usually light colored, and fossiliferous in part, but in certain districts approaches characteristics of the Blue. Upper parts are eroded in most districts
Intermediate beds
Up to 500'
Varies from limestone resembling the Blue through a shaly, impure variety, with characteristic minute fossils, to, in extreme cases, shale bands
Lower fossil limestone
100-400'
Single bed of limestone, light colored and often dolomitized since deposition
Blue limestone
Up to 1,500'
Upper quarter almost invariably highly fossiliferous. Some fossils occur throughout. In certain districts bottom also well supplied with fossils. The fossils are characteristic and the weathering typical
Said to be Lower Cretaceous (Comanchean)
Dark, dense, rather thinly bedded limestone, often cherty and usually free from fossils. In some districts this formation is practically absent
Underlying sandstone
5,000'
Shales predominate toward top, often reaching a thickness of 1,000' or more, though in some districts the thickness is almost negligible
Said to be Jurassic
Interbedded sandstones and shales. Portions of sandstones occasionally altered to quartzites. Thin beds of limestone occur

Fig. 1—Idealized geologic column, Mexican Province

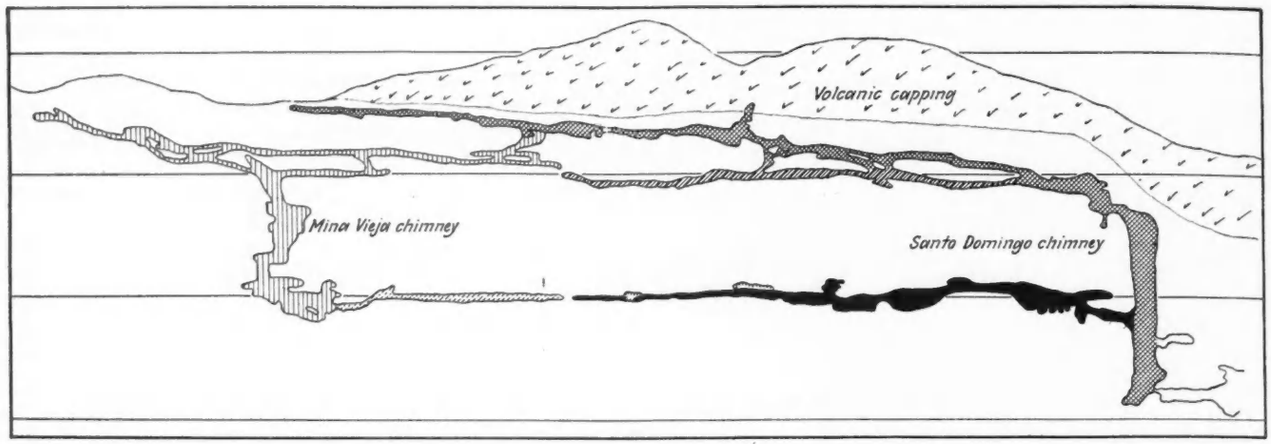


Fig. 2—Santa Eulalia, Chihuahua. Projection of same portion of district as shown in Fig. 3, but showing only Mina Vieja and Santo Domingo chimneys and mantos. Same scale and legend. By permission of American Smelting & Refining Co. and Cia. Minera de Peñoles

productive when they vary toward the heavy-bedded limestone characteristics, unproductive when they approach the shale characteristics. The Upper Bufa is productive either when the beds between it and the Lower Fossil horizon are limestone or when a means of introducing the mineralizer into them through the intervening barren beds has been provided by local geologic events. The limestones lying below the Upper Cretaceous shales are productive at times, but more often have been removed by erosion. Where the upper formation occurs, the exposure does not generally extend down sufficiently into the formations below to give much light on the lower part of the sequence.

About 3,000 to 5,000 ft. of limestone are found in the average section, but when seriously contorted this thickness may be increased, and exposures are known where the beds stand on edge for perhaps 5,000 ft.

The most suitable example for the purpose of illustrating the principles stated is one in which the limestones may be deemed reasonably favorable from the top of the Blue to the surface, say at least 2,000 ft.; where faulting and structure are not severe; where physical conditions governing deposition are quite uniform; where orebodies are numerous and of good size; and where development and extraction have been maintained over a sufficient period to have reached such a point that little is left to the imagination. The main zone of Santa Eulalia satisfies these conditions and will be used as the first example.

Application to Districts

Santa Eulalia

At Santa Eulalia the limestone lies in a scarcely perceptible dome, with its major axis north and south; the Lower Fossil horizon occurs at a depth of from 1,200 to 1,500 ft. below the collars of the shafts, while the Upper Bufa limestone outcrops on the surface wherever it is not capped by Tertiary volcanics or conglomerates.

The orebodies occur in pipes or chimneys, and in mantos or flats and runs; and, as the limestone lies nearly horizontal, the chimneys are those that cross the beds, the mantos those that follow more or less along the bedding, though frequently jumping from one bed to the next higher one. The chimneys vary considerably in size and are extremely irregular in shape. A large example may show a width of perhaps 100 ft. by a length of perhaps three times that amount and a height of 1,000 ft. or more. The mantos range from say 200 ft. in width by 15 ft. in depth, or 30 or 40 ft. in width by the same in depth, down to a total cross-section of say 30 sq.ft. Undoubtedly they get even smaller, but it becomes impossible, or at least unprofit-

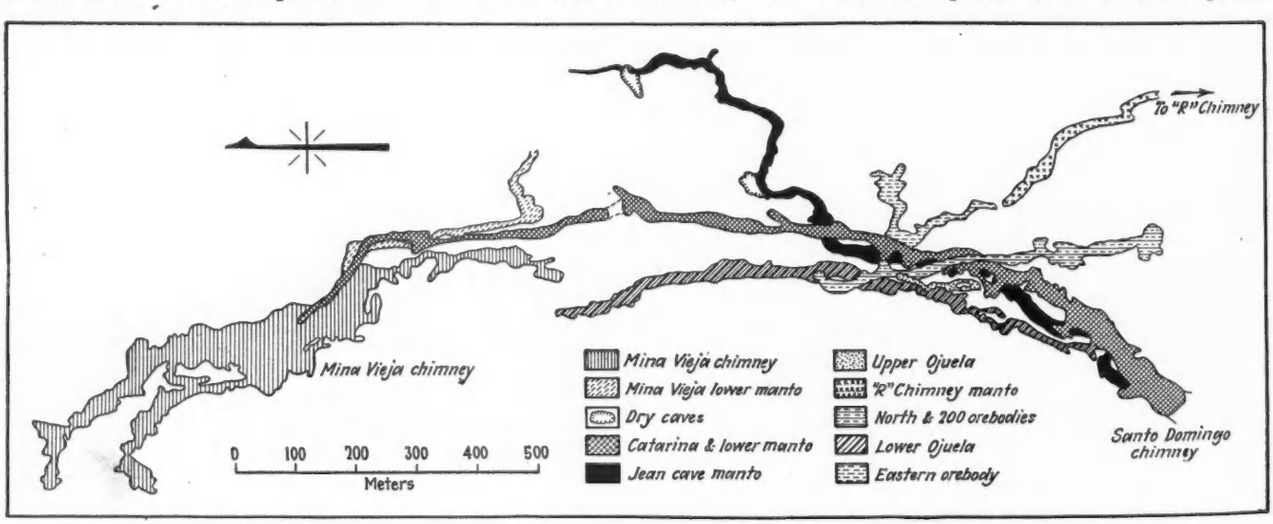


Fig. 3—Plan of portion of Santa Eulalia district, showing mantos and chimneys. By permission of American Smelting & Refining Co. and Cia. Minera de Peñoles

able, to trace and follow them. In length the mantos reach 12,000 ft. (Figs. 2, 3 and 4).

Three types of ore occur, representing the three main stages of mineralization. The earliest, a complex, rare silicate gangue, carrying a silver-bearing iron sulphide and insignificant amounts of lead and zinc, has a limited commercial development and no widespread distribution, though occurring at certain points in enormous masses. The second, a silver-lead-zinc type, is the standard ore of Santa Eulalia, the one that has been worked for generations, that has made the camp eral. As a rule, pre-mineral north-south fissures are not fault planes, though a few exceptions are known—one in the north of the camp and several others toward the south, around the "N" cross fault of Potosi ground. When examined in detail the pre-mineral fissures are found to be not very continuous, though, as they occur throughout the entire area, spaced at intervals of only a few meters, their continuity has been assumed when, in reality, several fissures were involved. Cross fissures are almost as numerous, so that intersections are beyond numeration.

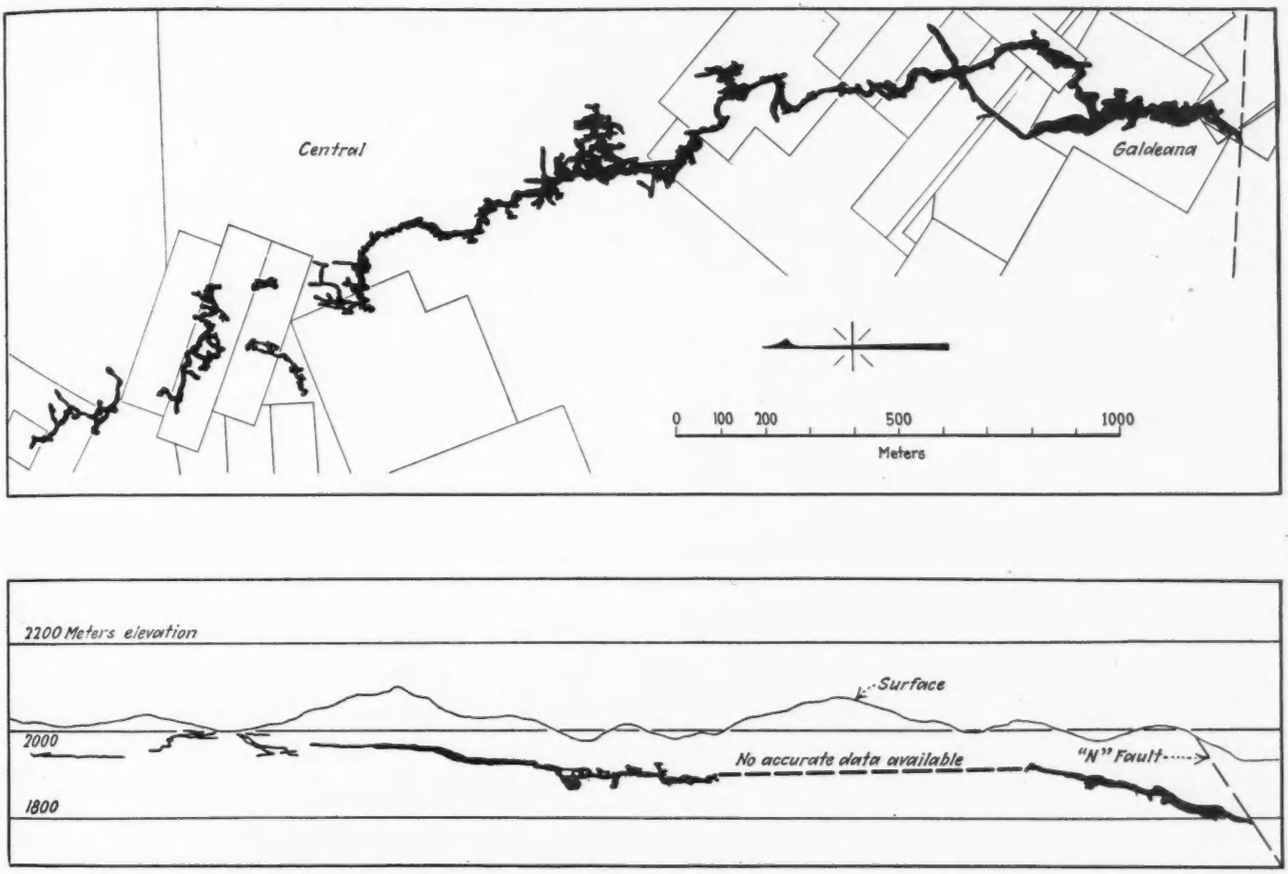


Fig. 4—Santa Eulalia, Chihuahua. Plan and section of Galdeana-Central manto from "N" fault north. By permission of Cia. Minera de Peñoles

famous, and the one that will always be meant in this paper unless a definite statement to the contrary is made. This ore, when sulphide, is identical with the standard pyrite-galena-sphalerite mixture of the Western United States, except for rather minor amounts of the rare silicates; and when oxidized is the common carbonate lead and zinc ore of the same districts. The ratio of the metals varies widely. The third type, chiefly galena or its oxidation products, relatively free from zinc and with only minor amounts of iron, is of geologic interest only, as its total production to date does not exceed 10,000 tons. The three types are readily distinguishable and usually, though not invariably, are separated in their occurrence, and, as was stated before, only the silver-lead-zinc mineralization of the second type will be considered here.

The limestone at Santa Eulalia is cut by innumerable fissures, which may be grouped into several systems on the basis of their age, dip, and strike, and of their characteristics. Those striking north-south, or within a few degrees of that course, are pre-mineral; all others are usually, though by no means invariably, post-min-

Fifteen years ago it was universally believed by those operating the camp that the mineralizer ascended more or less along the length of the fissures, as it is supposed to do in a vein, but deposited its burden only when certain favorable horizons were reached, where a manto was formed. A chimney was supposed to be a point where several fissures intersected and deposition then took place with vertical continuity.[1]

A delicate point comes up under this conception, as to just what degree of inclination decides the difference between a chimney and a manto, or, in other words, at just what pitch an orebody ceases to be fed at the lower end and begins to receive an accession of mineralization through a feeding fissure along the length of its lower side. Apparently no one doubts the vertical chim-

[1]In T. A. Rickard's paper on the Ahumada Lead Mine, published in the *Engineering and Mining Journal-Press*, Vol. 118, No. 10, the issue of Sept. 6, 1924, two plates, given on page 369, which were taken from Philip Argall's paper on Santa Eulalia, clearly illustrate this earlier view, and show the feeding fissure widening out into a manto by replacement of certain strata of the limestone. These illustrations have been often used, their simplicity and clearness conveying quickly the basic ideas involved; but I believe they paint a condition which does not exist in Santa Eulalia and illustrate a conception that is not supported by the evidence now at hand.

ney being just what its name implies, and that it is fed at the lower end; few question the point when the orebody is inclined at 45 deg., but opinions begin to diverge as this angle decreases toward the horizontal. Santa Eulalia makes an excellent example to consider this point, as, for all practical purposes, the chimneys are vertical and the mantos horizontal.

At Santa Eulalia the Lower Fossil horizon is very favorable throughout its seventy meters of thickness, the Upper Bufa limestone is favorable, and the Intermediate limestone rather favorable, for, although no mantos are formed in the latter, the chimneys, which are exceptionally large and strong throughout the entire thickness of the Lower Fossil horizon, go through the Intermediate limestone and up into the Upper Bufa with a normal cross-section, showing clearly that at Santa Eulalia all the limestone above the Blue is capable of replacement.

Under such conditions it would be expected that the hypothetical fissures feeding the manto would be large and strong throughout the Lower Fossil horizon—in fact, would be practically vein-like orebodies; would be clearly marked with mineral matter throughout the Intermediate limestone, and would open again throughout the thickness of the Upper Bufa—that is, would there be proportioned very much as shown in Argall's sketches. The actual facts of the case are that in no instance in Santa Eulalia can such a fissure be recognized even a few feet directly over the back of a manto orebody. Pre-mineral fissures exist at that point as knife-blade cracks, exactly as elsewhere throughout the entire area of Santa Eulalia, but the most careful, minute, and conscientious study fails to distinguish or differentiate between the supposedly feeding fissure and those innumerable accompanying ones that lie alongside. The pre-mineral fissures are not usually the channels of secondary action, hence they are not as a rule marked by the migratory products of oxidation, such as the oxidized zinc and iron minerals, but in exceptional cases, and then only over short lengths, they have served as channels for secondary solution, and in these cases, which it must be emphasized are extremely isolated, the pre-mineral fissures under the orebody may be marked in such a way that they appear to the inexperienced observer to satisfy the condition of a feeding fissure. In the vast majority of cases, however, it is as difficult to locate a so-called feeding fissure underneath a manto as it is above. When this point first came up, fifteen years ago, a large productive manto was being exploited on the Lower horizon in Buena Tierra and Velardeña ground, and a drift, with numerous auxiliary crosscuts, was run under the manto, chiefly for extraction, but partly in order to pick up indications that would expedite the exploration of the orebody. A conscientious effort was made to find one of the pre-mineral fissures at this point, but although they could be picked up as knife-blade cracks on either side, in this instance no fissure of pre-mineral strike—that is, parallel to the orebody—could be found directly under the known ore. This case is worthy of careful consideration, for the drift itself was well within the limits of the lower favorable limestone. The experiment detailed has been repeated time and again over nearly the entire area of the Santa Eulalia camp by several different observers, and invariably with the same results, so that it may now be confidently stated that, above or below a manto orebody, none of the pre-mineral fissures carries the slightest trace of primary mineralization and that, with the rare exception of the secondary oxidation products already noted, the so-called feeding fissure which passes through the manto cannot be distinguished from one on which no ore occurs.

If the ore came up along the vein-like feeding fissure, even admitting that it might be possible for it to pass through limestone proven favorable by the chimneys without leaving the slightest trace, it would then be expected naturally that the mineralization would not be equally distributed along the entire length of the fissure, but rather would occur in shoots, as does the ore in an ordinary vein. In that case the manto would be found in disconnected segments or at least with the shoots separated by narrow, relatively barren, spaces. Fifteen years ago this was considered to be the case, and, when a manto apparently pinched out, no further explanation was needed than that the end of the oreshoot had been reached. Since that time, spurred on by an entirely distinct conception of the principles involved, every manto has been followed back to its source at some chimney, and no orebody is now known in the main mines of Santa Eulalia which either is not so connected or on which development is not being pushed confidently and successfully. The accompanying sketches, we feel, prove clearly the first one of our principles: that is, the continuity of the orebody, and though a very small scale was used, some idea of the second principle—the constancy of cross-section—may be gained.

It is not always easy to follow a manto orebody, but after one has been worked out it is no easier to explain to a visitor why difficulty should have been encountered in following it, for a great open, though somewhat irregular, cavern seems to extend on indefinitely without interruption or constriction. In reality it has taken twenty years to push the Jean Cave manto to its present development and it is still being prolonged; the Velardeña manto was for a decade a short, disconnected segment, apparently isolated in the middle of the limestone, though now a normal occurrence connected to its chimney; while some of the older near-surface mantos have been extended intermittently for 200 years.

One constant variation in size occurs: as the distance from the source increases the cross-section of a manto gradually decreases until eventually it becomes too small to follow. A manto with a cross-section of 400 square meters near its feeding chimney will quite probably have a cross-section of not more than ten square meters a mile and a half further on. After being worked out there will be no constriction greater than that covered by our statement of the second of our principles, excepting where the orebody has been cut and offset by some post-mineral fault.

In very rare instances, and then usually at a considerable distance from its chimney, a manto may branch, and it is interesting and pertinent to note that such branching is accompanied by no increased size at the junction, but rather by a decrease in the cross-section of the main manto from and beyond that point.

Were the mantos formed by the enlargement of a feeding fissure on reaching favorable horizons, it would be expected that bodies would be formed wherever that fissure crossed a favorable horizon, and while development upward would be subject to the possibility of the mineralization having given out, development downward under a known manto along the fissure would, *per se*, encounter ore on any known underlying favorable

horizon. Unfortunately great sums of money have been expended in ill-advised development based on exactly the above erroneous assumption. A glance, however, at the accompanying plan and projection of a portion of the Santa Eulalia district (Figs. 2 and 3), where mantos are most numerous and chimneys lacking, shows the remarkable fact that in this prolific area no two of these mantos occur on the same vertical fissure, although each manto occurs on a distinct and independent horizon in the nearly flat-lying limestone.

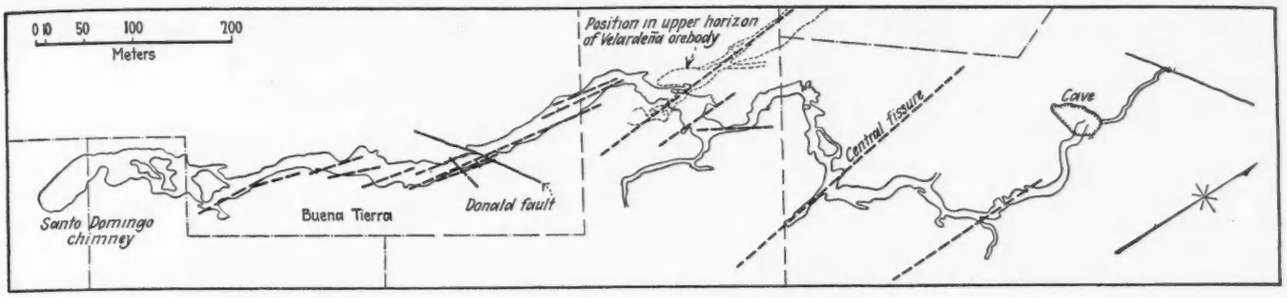


Fig. 5—Santa Eulalia, Chihuahua. Plan of Jean Cave orebody, showing relation to certain pre-mineral fissures. By permission of American Smelting & Refining Co. and Cia. Minera de Peñoles

Once again, were the manto formed by a feeding vein-like fissure, it would be expected that the manto orebody would follow the fissure continuously for its entire length. Referring again to the accompanying sketch of a portion of Santa Eulalia, showing orebodies and fissures, it is readily seen that this is by no means the case; on the contrary, though the fissures serve in a general way to guide the course of the manto, no one fissure is followed for any great length, and occasionally an erratic manto takes out across the country, apparently with entire disregard for pre-existing fissures. In this connection, the unique course of the Jean Cave manto may well be considered as conclusive (Fig. 5). The Santo Domingo chimney, which started to deposit well down in the Blue limestone, gave off this manto as a branch at the point where it passed through the Lower Fossil horizon. The manto worked gradually upward through the lower part of this horizon, making off toward the northeast without exact fissure control until it encountered a north-south pre-mineral fissure that seemed to suit its requirements, which it followed northward across the Buena Tierra ground into the Velardeña, and, after selecting its fissure, maintained a more or less constant position, just below the heavy band of fossils that marks the upper part of the same horizon. In passing, it may be noted here that the fossils themselves have apparently neither chemical nor physical effect on the localization of the ore, as has been considered by some, for the manto orebodies do not occur in the fossil band, but in the fossil-free limestone underlying it, often several meters apart.

After crossing the Buena Tierra line and entering the Velardeña ground, this manto, in following its course, came up against a pre-existing silicate-sulphide orebody of the earlier type, which body presented an impervious barrier similar to that which might have been presented by an extraneous mass, such as an igneous rock. As the fissure could no longer serve as control, the manto took off across the country with a somewhat erratic course toward the east. At this time the further development of this body was watched with great interest by operators, engineers, and geologists, and particularly by the exponents of the two opposed theories. In the overlying limestones there were a number of already worked-out mantos, all of which presumably had feeding fissures, and one of these fissures in particular, supposedly accountable for the old original Velardeña manto, came closer to satisfying the requisites of a fissure of the type painted by Argall than any ever encountered in Santa Eulalia, owing to its having been a channel for secondary leachings from the orebody. The manto, however, crossed the strike and location of this as well as all the other pre-mineral fissures, whether ore-bearing at some horizon or not, without the slightest deviation or enlargement. The exponents of the fissure theory retreated slowly from fissure to fissure, expecting an accession of mineralization and a governing control from each succeeding one; but, much to the surprise of all concerned, the manto crossed the Velardeña side line, entered the Central ground, and continued easterly until it suddenly selected one of the myriad of then unknown and unnamed pre-mineral fissures, which it followed northward. It has since been found to step eastward occasionally, but in general is working to the north with diminishing size, having never again shown the erratic course caused by its encounter with the silicate-sulphide mass.

A fair idea of the form and habit of the orebody that would result were the mineralization introduced from below along the fissures, as was formerly predicated for the mantos, may be derived from a study of the I-10 chimney and its branches (Figs. 6 and 7). This orebody is known for 200 ft. below the bottom of the fossil horizon, though scarcely of sufficient strength at that point to be worthy of development and exploitation. The body opens out on entering the lower favorable horizon and makes a strong chimney up through that bed, near the top of which it gives off to the north a typical manto, which has been followed as shown on accompanying maps, while a second manto started south on the same approximate horizon, but, upon encountering that strong group of pre-mineral cross-fissures known as the Inglaterra faults and dikes, these are followed upward, and continuous deposition along the fissure is found throughout the relatively unfavorable intermediate horizon where mantos are not known to occur in the camp. From a little above the point where the mineralization first encountered the fissure the orebodies extend along the fissures for a limited distance, quite like oreshoots on a vein, but above the third level the orebody, now considerably smaller in cross-section, leaves the fissures and mantos off to the south. This occurrence is unique for this type of mineralization in the main zone at Santa Eulalia, and seems to definitely eliminate the possibility of the fissures—in the much more favorable limestones above and below—having

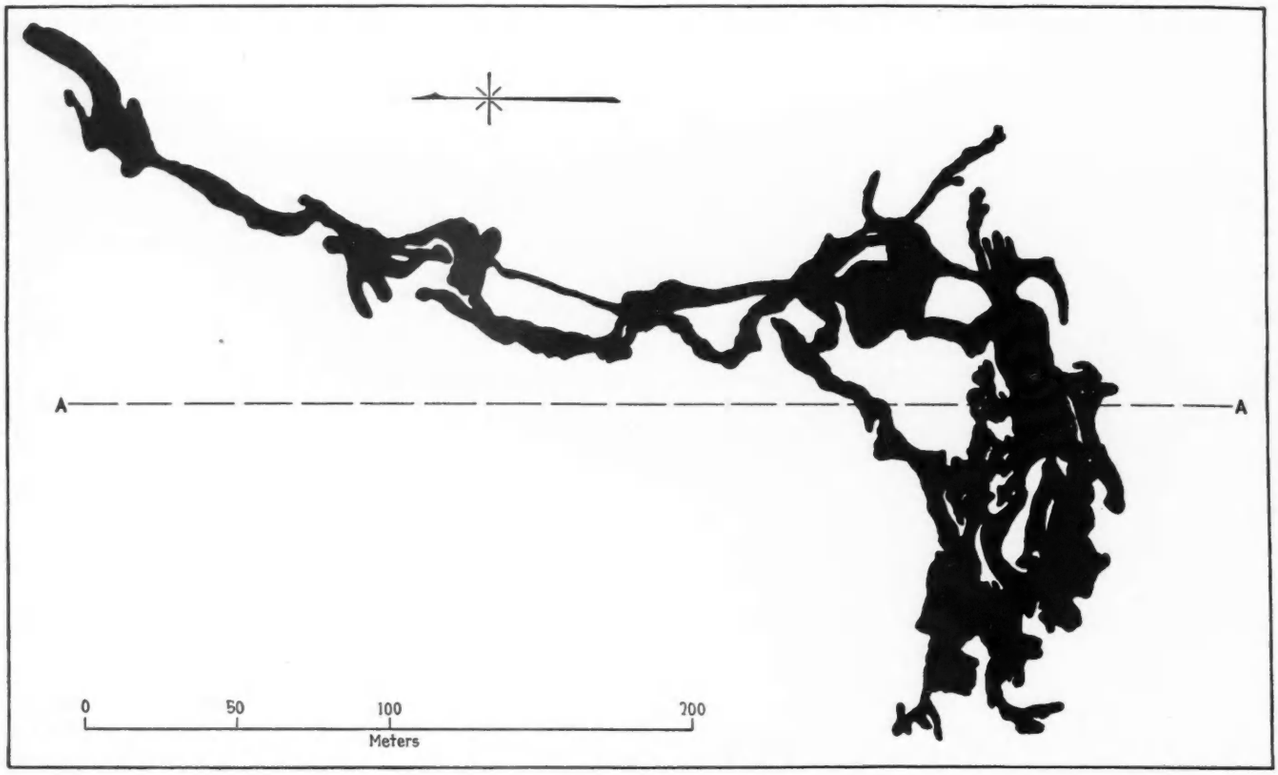


Fig. 6—Inglaterra mine, Santa Eulalia, Chihuahua. Plan of "I-10" orebody. See accompanying projection. By permission of Cia. Minera de Peñoles

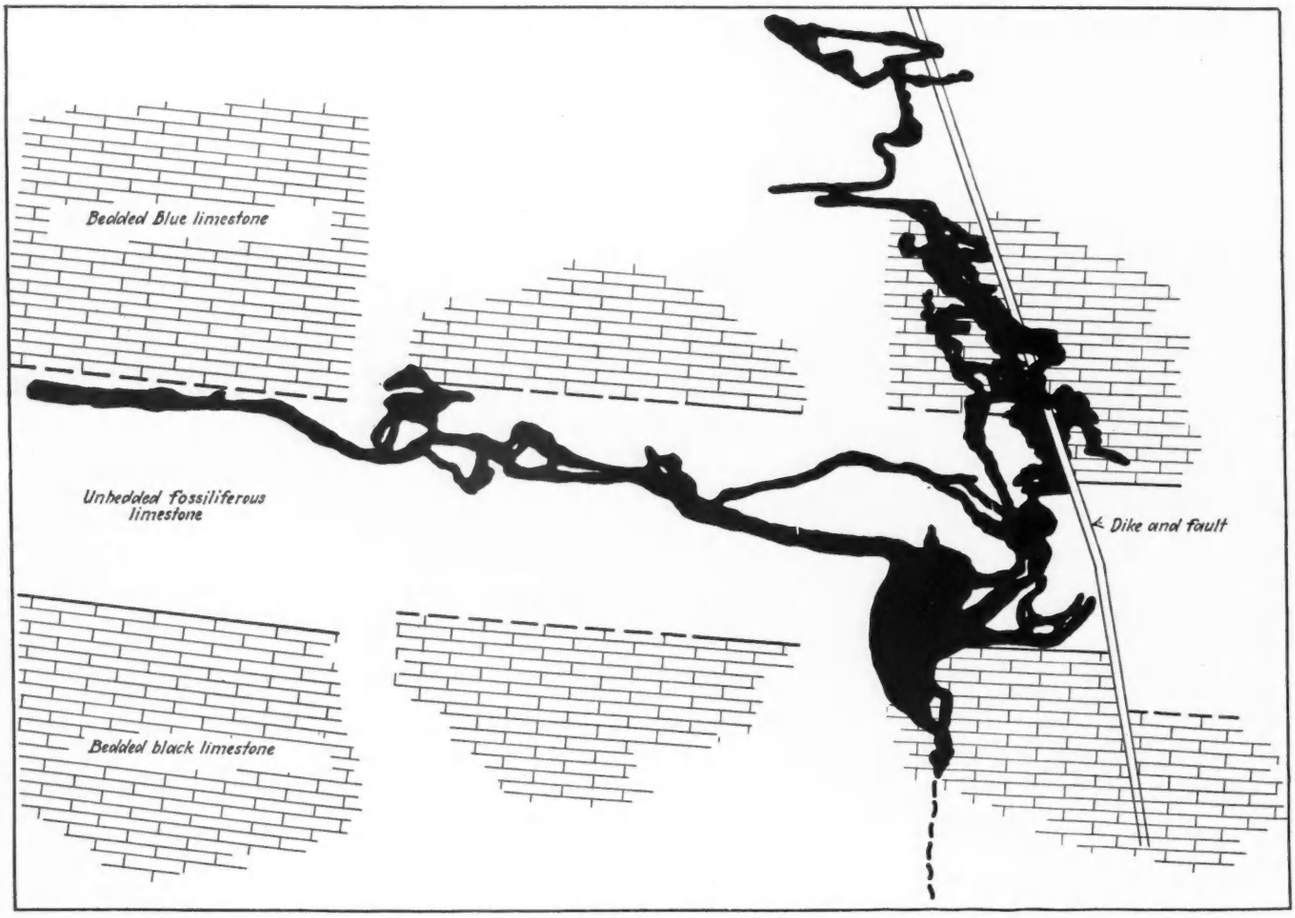


Fig. 7—Inglaterra mine, Santa Eulalia, Chihuahua. Projection of "I-10" orebody with geology of section "A-A." (See plan.) By permission of Cia. Minera de Peñoles

been channels through which the mineralization passed without leaving signs of its passage.

The third proposition, that the progress of the mineralizer is upward from its source, is not susceptible of demonstration and proof at Santa Eulalia, unless the diminution in the size of a manto is accepted as indicating increased distance from the source, in which case it will be noted on the accompanying sketches that the ends of the mantos farthest from the chimneys are the highest. As will be shown later, in most other districts, where the limestone is somewhat inclined, the proposition becomes more obvious. It can be readily proven, both at Santa Eulalia and in other camps, that the decrease in size of these mantos is not due to reaching the limits of the mineralized area, and for this purpose see Figs. 2 and 3, showing the Mina Vieja chimney giving off its mantos toward the south, and the Santo Domingo chimney with its mantos toward the north, with the decrease in size occurring toward the center.

Our fourth proposition, that the analysis of each orebody is distinctive and, broadly speaking, invariable, is dependent for proof on accurate data as to past production, which is seldom available in Mexico, Santa Eulalia being a notable exception. In this camp the total vertical range involved from the surface to the unfavorable underlying horizons does not seem to have been sufficient for any zoning of the metals, though such zonal arrangement is distinctly the rule in the vein deposits of the province.

The distribution of the metal content in an oxidized orebody varies extremely when one lump is compared with another, or the upper surface of the ore with the underlying irony mass; but when averages are obtained of the production of a given orebody over a sufficiently long period, a complete elimination of the minor variations results and a remarkable uniformity is established. As the normal grade of these bodies is well above the economic limit, and as replacement deposits are characteristically marked by sharp edges rather than the grading out of values into walls, it will be readily seen that such an average may often be quite accurate. For instance, one made from the production of the Tiro Alto orebody, in Central ground, last year, showed an analysis almost identical with a similar average prepared some ten years ago in the Buena Tierra ground on the same body, some three thousand feet away, and both are closely comparable with the production records from the Santo Domingo chimney ten years still earlier.[2]

The Mina Vieja chimney and its mantos produced an ore averaging less than 5 per cent lead and in the neighborhood of a kilo of silver, whereas the Santo Domingo chimney and branches, on the other hand, produced an ore running 12 to 14 per cent lead and about 250 to 350 grams of silver. Referring again to Figs. 2 and 3 it will be noted that the upper manto from Mina Vieja and the old Velardeña manto practically touched at one point. Fifteen years ago, when these two mantos were being developed toward each other apparently on the same fissure and horizon, they were watched with great interest to see just what would happen when they met; and when they finally failed to meet, but passed each other, it was felt that no further proof was needed as to the correctness of this principle. Its practical application is interesting. When a new manto is picked up in some previously undeveloped area it is of first importance to determine whether the ore comes from any one of the known chimneys, and, if so, which one. As soon as sufficient ore is produced to eliminate local variations an average analysis is obtained, which is compared with the possible sources, and a chimney selected as its probable point of origin. In several instances an obviously near-by chimney was passed up for one lying at great distance by this method, and, so far, development has in every case shown such deductions to be warranted and correct.

The illustration selected above is an extreme case of a low lead-high silver ore and a high lead-low silver ore; but even when the comparison must be made between the ores of two bodies of intermediate composition, careful comparison of the complete analyses will usually yield specific distinguishing characteristics.

Up to this point a brief attempt has been made to establish that the orebodies are continuous, their cross-sections fairly constant except for a gradual decrease in size with distance from the source, that the mantos are not fed from underlying fissures, but are branches of the chimneys, and that the analysis of a chimney and its branches or mantos is constant and distinctive. If this is accepted, it seems obvious that the fifth proposition—that the ore deposited in the portions farthest from the source, whether in mantos or chimneys, has passed through and inside the walls of the orebody nearer the source—is proven.

Though two mantos seldom occur on the same fissure, there is a remarkable grouping of orebodies at certain points and along certain lines. Undoubtedly part of this is due to factors and features pertaining to the underlying rocks through which the ore passed before reaching the limestone, and, though such factors unquestionably control the localization of the chimney, not even a guess can be hazarded as to their nature and character. On the other hand, there will be noted on Fig. 3 a marked tendency for the mantos, from several different, quite widely separated chimneys, to make toward and then follow along the same general line. To reach such a position many of the orebodies must cross the course of the pre-mineral fissures, which, as we have pointed out, are practically all nearly parallel in the area under consideration, and, therefore, some guiding tendency is at work which is stronger than that of the fissures. Though it is not the intention to discuss these matters in the present paper, it is believed that this control is exercised by almost imperceptible structure.

Before taking up the remaining principles and their corollaries, and particularly before discussing the rôle that fissures play in these deposits, it would be well to consider several other limestone occurrences and note whether or not they support the basic principles that govern Santa Eulalia.

(To be continued)

[2]The following table shows a comparison between the average analyses of the production for the year 1913 from the Santo Domingo chimney mantos in the Buena Tierra ground under low lead prices, and that of the year 1925 from one of the same orebodies in Tiro Alto ground, three thousand feet further out from the chimney, mined under high prices. Every possible condition has varied, but the orebody remains constant in grade, though greatly reduced in size.

	1913 Per Cent	1925 Per Cent
Pb	11.3	12.92
Fe	26.4	25.23
CaO	7.0	8.24
Ins	19.1	21.00
S	0.8	1.00
Zn	5.5	2.00

The only variable, the zinc, was present in the sulphide ore in amounts varying from 10 to 12 per cent, but in the oxidized ore the amount of the zinc is dependent upon the efficiency of the leaching during oxidation, and hence is not diagnostic.

Manganese and Bauxite in India

By S. B. Banerjea
Calcutta, India

OF SEVERAL MINERALS which are exported from India to the United States manganese takes the lead. During the World War not one manganese mine was idle, for there was a standing government order that every ship leaving India's shores must carry a load of manganese. The result was that mine owners increased production, the prices rose and large profits were made. Several new fields were opened by venturesome merchants, resulting in an accumulation of stocks.

With the cessation of war, the demand for manganese went down, prices fell, and several mines were closed. Last year, a sudden demand for manganese came from Japan. Even low-grade ores of 35 per cent were sold at good prices. At once, there was a huge demand for salable properties. Prospectors began to take out prospecting licenses for manganese-bearing properties. There were more applications for licenses for manganese than for all other minerals combined. Clever fellows thought that there was a fine chance for making money at little expense, with the result that prices went up. The greedy ones have now had the surprise of their lives. The demand for the ore has suddenly ceased. Even first-class ore is difficult to sell. The fact is the stocks in the United Kingdom, Japan, and the United States are now large. It is reported that the operations of the Harriman company, which is flooding the market with manganese from its Caucasian concession, has something to do with the sudden cessation of demand.

Indian manganese ore is largely shipped from Calcutta, and to a lesser extent from Bombay, Madras, and Goa. The railway freight from the mining areas to the nearest ports are, no doubt, high, and labor has gone up, but it is the high prices for manganese ore that are being charged by the sellers, which, to my mind, are responsible for the cessation of orders. In pre-war times, first-class ore could be had at 18 to 20 rupees per ton, f.o.b. port; during the war, it sold at 25 to 30 rupees per ton; and last year it sold at 35 to 40 rupees. Certainly, the overhead charges have not gone up so high as to lead sellers to charge a heavy price. I opine that until they reduce their prices to a reasonable figure they will not be able to sell their ore.

It is interesting to note in this connection that at one time Brazilian ore was a formidable competitor of Indian ore in the American markets; and now it is the Caucasian ore. Not having seen an analysis of the last-named ore, I cannot say whether it will be able to compete with Indian ore for any length of time. Rough Indian ore shows on analysis 46.8 per cent metallic manganese, 5.60 iron, 2.00 silica, and .007 phosphorus. Good ore contains from 48 to as much as 55 per cent metallic manganese. The best class of ore has always commanded high prices, and is available from certain mines in large quantities. The Bengal ore is mainly low-grade and naturally is not exploited. Bengal exports ores of other provinces and does not produce any notable quantity.

India contains several vast deposits of bauxite, but only one or two of these are worked. It is estimated that the world's requirements of bauxite are about three million tons. India can fully meet at least half of that amount. But the trouble is that America, the second biggest buyer (France being first) offers only $5 to $8 per ton of 2,240 lb. Freight from the mining area to the nearest port is about $3 per ton. Mining and shipping costs amount to about $5 per ton; so there is no margin of profit left, and consequently little export. One province contains an enormous deposit of bauxite remote from transportation. The state will not grant any concession to a white man, and an Indian financier of the right kind is not to be found who will attempt to open the deposit on a commercial scale.

In France, cement manufacturers use bauxite in the manufacture of aluminous cement. The bauxite composition dries in twenty-four hours, whereas the ordinary cement takes twenty-one days to dry; hence a good demand for the ore. If the Indian railways can reduce their freight considerably and other charges can be decreased then a profitable trade with the United States and France may be set up. The Indian railways are not disposed to give the relief sought until they are assured of a big volume of business, so it is probable that a really profitable business will remain undeveloped.

There is another difficulty in the way: non-British investors are not allowed to own any mineral property in India. American financiers, therefore, even if willing to develop her mineral resources, can do nothing in the matter.

Power-Plant Boilers Work Much Harder Now Than Formerly

In a leading article on "Progress in Power Plant Design," in a recent issue of *Power*, F. R. Low makes some interesting comparisons of present practice with that of twenty-five and thirty-five years ago. In 1891, in water-tube boilers, less than 14 lb. of coal was burned on an average per square foot of grate surface and less than 0.3 lb. per square foot of evaporating surface per hour, and 10.58 lb. of water was evaporated per pound of combustible. "We are not doing very much better in efficiency today," says Mr. Low, "but Hell Gate burns five times as much coal and evaporates about five times as much water per square foot of heating surface per hour. Surface subjected to radiant heat evaporates 40 lb. or more per square foot, and the present tendency is to put more and more of the heating surface where it can see the fire."

In 1900 the average steam rate of condensing engines was 21, and of the non-condensing engines 32.7 lb. per horsepower-hour, which is about 28 and 44 lb. per kilowatt-hour respectively. Turbines are now sold under guarantee to produce a kilowatt-hour on less than 10 lb. of steam.

"True, to make the higher-pressure superheated steam requires more heat per pound, but not in anything like this proportion. Reduced to a heat basis, 28 lb. of steam at 100 lb. gage worked to a vacuum of 26 in. would be equivalent to over 30,000 B.t.u. per kilowatt-hour. Modern stations are running on less than half of this."

The average steam pressure in sixty engine tests cited by Mr. Low was 101 and the highest 167 lb. There were a few cases of the use of superheat, the highest 82, the average 41 deg. "Today pressures above 350 lb. and temperatures over 750 deg. are part of the day's work, and a successful installation is running with an initial pressure of 1,200 lb."

Proposed Method of Retreating-Bench Stoping

By Frederick Taber Rubidge
Mining Engineer, New York City

WHEN the overburden in quarrying or open-cut mining becomes excessive, operations must either be abandoned or, if economically possible, continued by underground methods. The cost sheet will show clearly when the overburden becomes so great as to necessitate the abandonment of surface operations, but it cannot show when the point has been reached where underground operations will be the more economical. To determine this requires a careful study of the possible underground methods suitable to the conditions, and the costs involved.

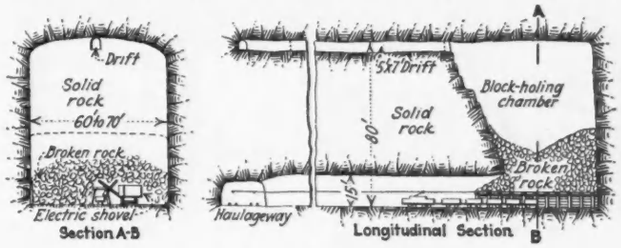
The one great disadvantage inherent in all surface quarry operations is the time lost through inclement weather. The amount of time so lost varies with the locality, but even in regions where the climate is normally good the percentage of lost time is surprisingly large. Rain for an hour or two in the morning will frequently mean the loss of the whole shift. In the localities where winters are severe, snow and ice cause either a suspension of operations or abnormally high operating costs. Usually the quarry is walled in on three sides, a condition which makes it extremely hot in summer, particularly if the face has a southern exposure. My experience in operating mines in the vicinity of quarries is that men prefer working underground during the greater part of the year. This is because the underground temperature is practically constant throughout the year, an advantage which more than offsets the disadvantage of lack of sunlight and the consequent cost of illuminants.

Surface quarries may be transformed into underground workings most simply, where the rock is of such a character as to permit of chamber operations, by advancing the face under cover of solid rock and restricting the width to safe limits. The back of the chamber should be carefully arched, and a sufficient thickness of solid rock should be left to support itself and the overlying burden. Ordinarily a thickness of from a quarter to one-third the width of the chamber will suffice. The output from a single chamber of this kind will vary from time to time because of the necessity of periodically removing all broken rock in order to drill and blast the toe. Also, it may be necessary occasionally to do considerable trimming or scaling of the back, at which times the output may be cut off entirely. For these reasons it is advisable to carry at least two such chambers, with a pillar of adequate width intervening.

Chamber mining by the method outlined above is hazardous even when the ground stands well. To give reasonably low costs the back must be fairly high, but this in turn makes the scaling of loose ground more difficult, and increases fear on the part of the men. For these reasons the advancing-bench stope method should be avoided if possible. An alternative method that I propose overcomes in a large measure these objections, and has many other advantages: retreating bench stoping.

In the retreating-bench stope method, as proposed, the work is started by first running drifts along the center line of the chamber at both the top and the bottom, and connecting these drifts at the far end with a raise. The floor drift is then increased in size so as wholly to undercut the proposed chamber, with a height sufficient to permit the use of an air or electric shovel for loading the broken rock. The next step is to widen the raise to the full width of the chamber, thus forming the end wall and providing a starting point for the bench stoping.

A timber drift, large enough to permit the entry of the cars to be used, is then started at the end wall over the track which was laid in driving the center drift. Bench stoping begins at the top, shooting the rock down



Sketch showing details of proposed plan

upon the timber drift, after first providing a protecting cover of rock. The timber drift is extended as the stope advances, being kept only sufficiently ahead of the solid rock in the bench to prevent the broken rock from falling on the track. Its purpose is to provide tail track for the cars when loading. The free end of the timber drift will require bracing from the roof to prevent careening from unequal side pressure of broken rock during loading operations. Power shovels which require a headroom of 13½ ft. have a clean-up radius of about 17½ ft., thus permitting a chamber width of 70 ft. by working alternately on either side of the track.

Loading after each blast is carried only to the point where an opening appears between the broken and solid rock. The idea is to prevent large pieces of rock from rolling down to the floor when blasting the benches, so that they may be blasted up in the stope and thus avoid interference with loading operations. The method will be more clearly understood by referring to the sketches herewith presented, which show longitudinal and transverse sections at one stage of the work.

It will be observed that about 25 per cent of the rock broken will remain in the stope as broken rock reserve until all blasting is completed. This is afterward removed, taking out the timbers of the timber drift as the work progresses. During this operation the loaders will have to work under the high back, but as no blasting other than occasional block-holing is done at this time, the hazard is somewhat lessened. Loading of any portion of this rock by gravity through chutes in the timber drift will not be economically possible if the blasting has been properly done, for the aim is to use no more explosive than is necessary to reduce the rock to a size that will enter the dipper of the shovel. Obviously, the initial crusher should be large enough to take any chunk that will pass through the dipper.

To appreciate the advantages of the proposed method one must consider the disadvantages of the advancing-bench stope method, which are as follows: (a) All men in the stope work under high back. (b) Output is reduced during drilling and blasting of the toe, and cut off entirely during trimming of the back. (c) Blasting requires the removal of piping, tools, and power shovel to prevent damage, and entails considerable cleaning of

floor before shovel can again work to best advantage. (d) Drill runners must climb up to their work under unscaled roof and over broken rock likely to slide. (e) Loading is delayed during block-holing. (f) A double track is required and much switching of cars is necessary in loading. (g) It is difficult to maintain the tracks in good condition. The proposed retreating-bench stope method has none of the disadvantages mentioned. Its main disadvantages are the time required to get into economical production and the capital tied up in broken rock. Shrinkage stoping will be necessary if the ground does not stand well, and when power loading is not used it is a cheaper method than those processes above described.

To minimize the amount of capital tied up in broken rock, the stope should be advanced on the incline. Where there is sufficient height above the haulage level the best plan is to open the stope through raises spaced at regular intervals on either side of the haulageway. Preferably, there should be an offset near the head of each of these raises where a grizzly of inverted rails may be placed, affording opportunity to blockhole chunks and thus prevent the loading of rock that will not enter the crusher. Each grizzly chamber must have a manway connection with the haulageway.

Other mining methods may be applicable under special conditions, but in general the value of the product is too low to permit of methods which require either large initial outlay of capital or entail high costs. Any underground method is more expensive than hillside quarrying under good conditions. It is therefore desirable to consider the possibility of competition from such quarries before deciding to embark in underground quarrying.

Mining Progressed in Mexico During 1925

ALTHOUGH the Mexican mining industry was affected by adverse legislation and labor agitation in 1925, the favorable prices for silver, lead, and zinc gave an impetus to production and exploration, according to *Commerce Reports* for July 12. The output of both lead and zinc was higher than ever before, and silver production—although somewhat below the 1924 level—showed an increase over the three preceding years, as did also the production of gold.

The district of Pachuca continued to hold its position as the world's largest silver producer; such camps as Parral, Fresnillo, and Zacatecas also showed increased production of silver, partly owing to the treatment of zinc-lead ores by flotation, with a corresponding production of the associated silver. On the other hand, it is reported that the large camps of El Oro and Guanajuato experienced a falling off in production.

A comparison with average prices of metals in United States currency prevailing in 1925 with the average for 1924, shows that silver rose from $0.668 to $0.6906, lead from $0.081 to $0.09, copper from $0.13 to $0.1404, and zinc from $0.063 to $0.0762. These increased prices, taken in conjunction with the high output of the mines generally, indicate that the Mexican industry was fairly prosperous during 1925.

Selective Concentration of Ores

The increasing number of flotation plants for the selective concentration of silver-lead-zinc ores, along with other evidences of progress in ore treatment, is particularly significant, since it is enabling mining companies to develop orebodies which in the past have been ignored because of the base character or low grade of the ore. During the many years of cyanide operation on the precious metals, considerable quantities of the baser metals were encountered, but as a rule the prices of these, combined with the lack of metallurgical refinement, lent little inducement to further development; but with the gradually decreasing reserve of cyaniding ores, several of the companies engaged in mining and milling have combined the treatment of cyaniding and flotation of ores with one mill, by which method production has been maintained, and in some cases the output value has been increased.

With higher prices prevailing, the application of the flotation process to the production of lead, zinc, and silver has been particularly advantageous. These improvements have made possible a pronounced separation of the lead and zinc, the lead concentrate with considerable silver content being shipped to the Mexican lead smelters while the zinc concentrate, with comparatively little silver, has been sent to smelters abroad.

Labor and Other Difficulties

In view of the large expenditures for mining machinery and equipment during the last year, it may be assumed that though the price of ore has had a stimulating effect the mining companies do not consider good conditions as temporary only. There are, however, continuing labor difficulties and, in addition, the problem of increasing taxation under a number of heads. In spite of the strong nationalistic spirit in Mexico, it is realized by the national leaders that development of domestic mineral resources is dependent upon foreign financial and managerial assistance, which will not be available without a reasonable assurance of adequate profit and protection.

Production Statistics

According to statistics published by the Mexican Department of Mines, 3,176 petitions for mining concessions, involving 39,722 hectares (1 hectare = 2.471 acres) of land, were filed with that department in 1925, as compared with 2,011 petitions, covering 25,006 hectares, in 1924.

The production of the principal minerals of Mexico during 1924 and 1925 and the average monthly output of last year follow:

Mexican Mineral Production in 1924 and 1925, in Kilograms

Product	1294	1925 Total	1925 Monthly Average
Gold	24,647	24,541	2,045
Lead	164,140,130	171,767,429	14,313,953
Silver	2,844,104	2,889,128	240,761
Copper	49,113,194	49,533,644	4,278,005
Zinc	18,936,336	45,770,328	3,814,192
Mercury	36,665	38,721	3,227
Antimony	774,567	1,399,483	116,624
Arsenic	1,293,436	3,948,564	329,047
Tin	8,849	1,033	86
Graphite	8,023,417	5,839,226	486,602

Measuring Volume of Low-pressure Air

Device and Procedure Developed at the Old Dominion Concentrator Is of Special Application in Connection With Pneumatic Flotation Cells

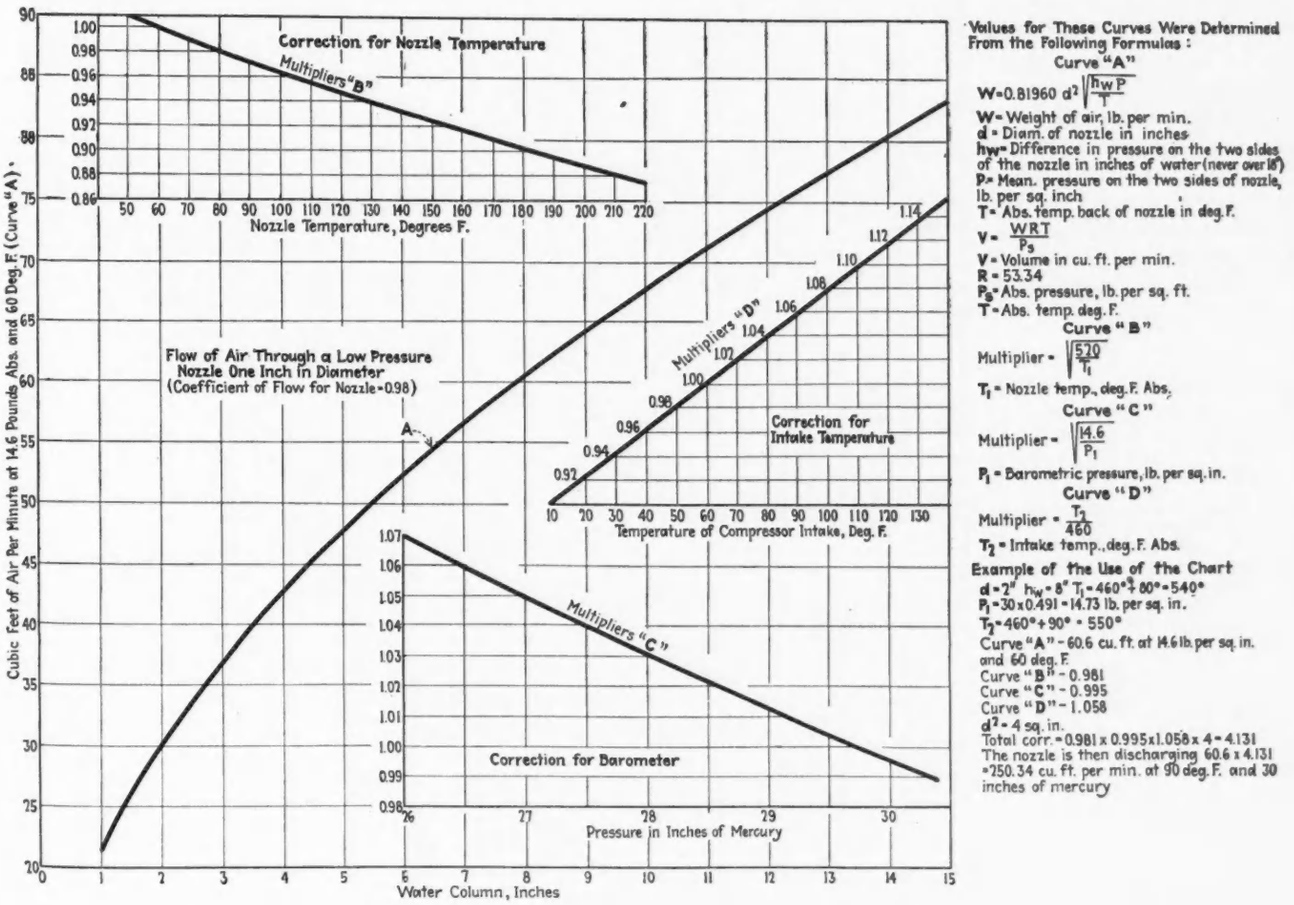
By E. H. Oneal and C. T. Todd
Mechanical Engineer, and Mechanical Testing Engineer, Respectively, Old Dominion Co., Globe, Ariz.

E. H. Oneal

DURING the last year the concentrating department of the Old Dominion Co. has been conducting tests to get an idea of the amount of air different pneumatic flotation cells were using under varying conditions. A number of meters would normally have been required, but the expense of installing any of the standard air meters on the market was decided to be prohibitive, so the mechanical department was asked to devise a means for measuring the air consumption. The method to be described has since been used and found to be of valuable service by several of the large concentrators in the Southwest.

We were unable to find any data on air measurements for similar service; however, from an article of some years ago by Professor Weeks in the *Mining and Scientific Press*, on testing air compressors, and from information given in engineering and manufacturers' hand books, the following data were assembled for the method used for our tests. Later formulas have been developed for

C. T. Todd


Correction for Nozzle Temperature
Multipliers "B"
Nozzle Temperature, Degrees F.
Flow of Air Through a Low Pressure Nozzle One Inch in Diameter (Coefficient of Flow for Nozzle-0.98)
A
Multipliers "D"
Correction for Intake Temperature
Temperature of Compressor Intake, Deg. F.
Multipliers "C"
Correction for Barometer
Pressure in Inches of Mercury
Cubic Feet of Air Per Minute at 14.6 Pounds Abs. and 60 Deg. F. (Curve "A")
Water Column, Inches

Values for These Curves Were Determined From the Following Formulas:

Curve "A"

$$W = 0.81960\, d^2 \sqrt{\frac{h_w P}{T}}$$

W = Weight of air, lb. per min.
d = Diam. of nozzle in inches
h_w = Difference in pressure on the two sides of the nozzle in inches of water (never over 15")
P = Mean. pressure on the two sides of nozzle, lb. per sq. inch
T = Abs. temp. back of nozzle in deg. F.

$$V = \frac{WRT}{P_s}$$

V = Volume in cu. ft. per min.
R = 53.34
P_s = Abs. pressure, lb. per sq. ft.
T = Abs. temp. deg. F.

Curve "B"

$$\text{Multiplier} = \sqrt{\frac{520}{T_1}}$$

T_1 = Nozzle temp., deg. F. Abs.

Curve "C"

$$\text{Multiplier} = \sqrt{\frac{14.6}{P_1}}$$

P_1 = Barometric pressure, lb. per sq. in.

Curve "D"

$$\text{Multiplier} = \frac{T_2}{460}$$

T_2 = Intake temp., deg. F. Abs.

Example of the Use of the Chart

$d = 2''$ $h_w = 8''$ $T_1 = 460° + 80° = 540°$
$P_1 = 30 \times 0.491 = 14.73$ lb. per sq. in.
$T_2 = 460° + 90° = 550°$
Curve "A" = 60.6 cu. ft. at 14.6 lb. per sq. in. and 60 deg. F.
Curve "B" = 0.981
Curve "C" = 0.995
Curve "D" = 1.058
$d^2 = 4$ sq. in.
Total corr. = 0.981 x 0.995 x 1.058 x 4 = 4.131
The nozzle is then discharging 60.6 x 4.131 = 250.34 cu. ft. per min. at 90 deg. F. and 30 inches of mercury

Fig. 1—Chart for discharge of air through a nozzle

Note: The chart is the same as that given by Walter S. Weeks in "Testing an Air Compressor," *Mining and Scientific Press*, April 6, 1918. All values have been recalculated and plotted.

air computations, but from the data we had available the one used by Professor Weeks seemed preferable.

Air is furnished by Roots blowers at a maximum pressure of 7 lb. per square inch, and usually under 5 lb., the pressure depending on the amount of blinding in the flotation cells.

The meter, as shown in Fig. 2, consists of two pieces of 12-in. pipe with a plate welded into one end of each piece. These plates are tapped for the inlet and outlet air lines. The other end of each piece of pipe has a standard-weight pipe flange, an orifice diaphragm fitting between the pair of flanges. The top of the outlet side of the meter is tapped for a mercury well, in which the thermometer is placed. The bottom of each pipe carries a ¼-in. nipple for connecting the differential water manometer. On the discharge side of the meter, a mercury manometer for static pressure is also connected. The cross-section of the meter should preferably be not less than twenty times that of the orifice.

The formula used is

$$W = 0.81960\, d^2 \sqrt{\frac{h_w P}{T}}$$

where W = weight of air in pounds per minute
d = diameter of nozzle or orifice in inches
h_w = difference in pressure on the two sides of the orifice in inches of water. (Should be kept below 18 in.)
P = mean absolute pressure on the two sides of the orifice in pounds per square foot
T = absolute temperature back of orifice in degrees Fahrenheit.

A coefficient for the type of orifice used must be applied; that for the bell-shaped orifice may be taken as 0.98 and for the thin plate as 0.64.

The weight of air having been found, the volume may be calculated for a standard set of conditions, or in terms of free air at the prevailing barometer and temperature. This may be done by taking the weight of air per cubic foot for the desired condition from tables to be found in engineering handbooks, and dividing into the number of pounds, or the chart, Fig. 1, may be used.

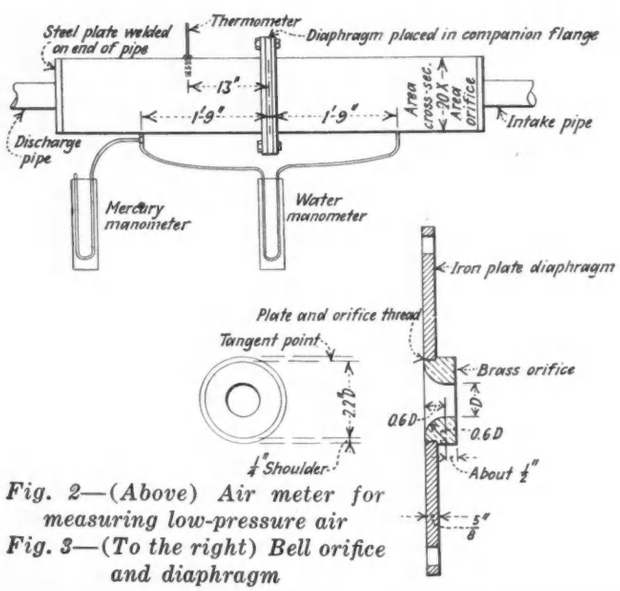


Fig. 2—(Above) Air meter for measuring low-pressure air

Fig. 3—(To the right) Bell orifice and diaphragm

As an example of the flow formula and first method mentioned above:

Let Atmospheric temperature = 78 deg. F.
Barometer = 26.5 in.
Weight per cubic foot of air (from tables) = 0.0651 for above conditions.
Meter or orifice temperature on discharge side = 125 deg. F.

Substituting in formula, $W = 0.81960 d^2 \sqrt{\frac{h_w P}{T}}$ with coefficient of discharge, 0.64.

The symbols then will have the following values:

$T = 125 + 460 = 585$ deg. F. abs.
$h_w = 5.1$ in. water
$d = 2.8$ in.
$P = 2{,}285$ lb. per square foot, found as follows:

Static pressure on discharge end of meter is 5.7 in. of mercury or $5.7 \times 0.49 = 2.79$ lb. per square inch, or $2.79 \times 144 = 402$ lb. per square foot.

To reduce this to absolute pressure, add barometric pressure, 26.5 in. mercury, times 0.49 times 144 = 1,870 lb. per square foot.

Difference in pressure on two sides of orifice, 5.1 in. water, equals $\frac{62.5}{12} \times 5.1 =$ 26.6 lb. per square foot.

Then the mean absolute pressure, P, $= 402 + 1{,}870 + \frac{26.6}{2} = 2{,}285$ lb. per square foot.

Then,

$$W = 0.64 \times 0.81960 \times 2.8^2 \sqrt{\frac{5.1 \times 2{,}285}{585}}$$

$= 18.4$ lb. air per minute.

Since the weight of air per cubic foot for our conditions = 0.0651,

then $V = \frac{18.4}{0.0651} = 283$ cu.ft. per minute.

The chart, Fig. 1, is based on the work of Professor Weeks, and the following brief explanation is given for the benefit of those who do not possess this article.

Curve "A" is based on a temperature of 60 deg. F., and absolute pressure of 14.6 lb. for a bell-shaped orifice 1 in. in diameter with coefficient of 0.98; the formula being $V = \frac{WRT}{P_S}$ where

V = volume in cubic feet per minute
W = weight in pounds
R = 53.34
T = absolute temperature = 520 deg. F.
P_S = absolute pressure in lb. per square foot $= 14.6 \times 144 = 2{,}102.4$.

With orifice temperature at T_1 instead of 520 deg. abs., the multiplier $\sqrt{\frac{520}{T_1}}$ is used to correct to the standard of 60 deg. F. This is plotted on curve "B."

In the same way, the volume will vary with the square root of the ratio of average absolute pressures or, without appreciable error, the ratio of barometric pressures may be used, that is $\sqrt{\frac{P_1}{14.6}}$. This still leaves the volume as measured at 14.6 lb. per square inch. To get volume at pressure P_1, multiply by $\frac{14.6}{P_1}$, making the total correction $\frac{14.6}{P_1} \times \sqrt{\frac{P_1}{14.6}} = \sqrt{\frac{14.6}{P_1}}$.

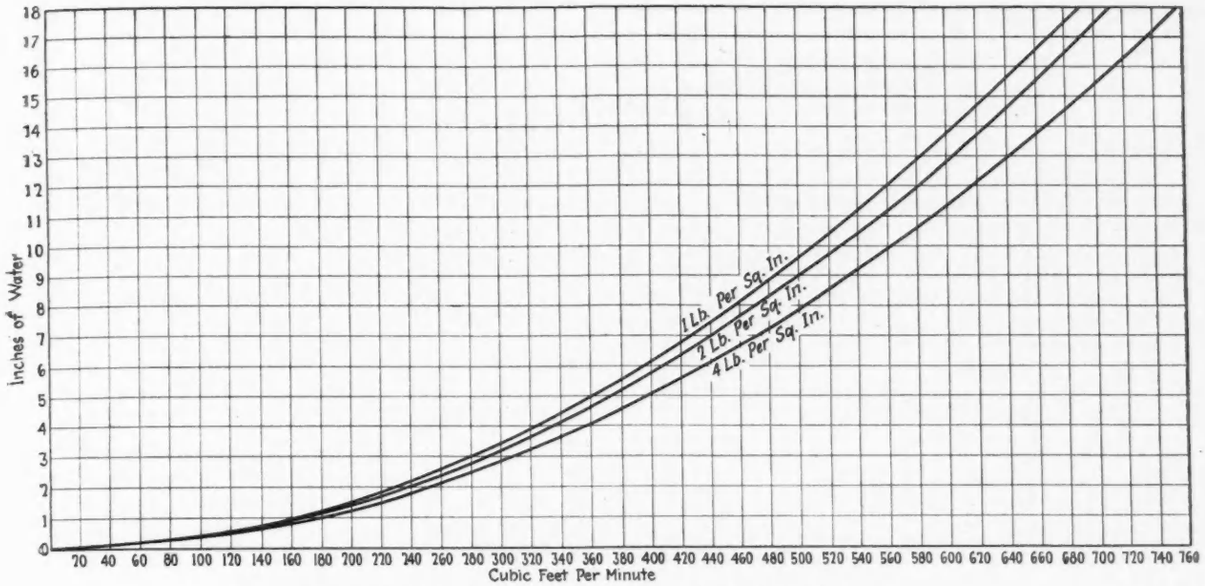


Fig. 4—Curves for low-pressure air meter

This is the basis of curve "C," with the pressure expressed in inches of mercury.

Now having the air at 60 deg. F. and at existing barometric pressure, to compute the volume at intake pressure it is merely necessary to multiply by the ratio of absolute temperatures. This is plotted in curve "D." This final result is then multiplied by the square of the diameter.

As an example of the use of the chart, Fig. 1, consider the problem of designing a bell-shaped orifice to pass 255 cu.ft. per minute with an assumed difference in pressure of 9 in. of water, intake temperature of air at blower 60 deg. F., orifice temperature 80 deg. F., barometric pressure 26.0 in., coefficient of discharge 0.98.

From curve "A" is obtained 64.3 cu.ft. air per minute; curve "B" gives factor 0.981; curve "C" 1.069; and curve "D" 1.000. Total correction factor is then 0.981 $\times$ 1.069 $\times$ 1.000 = 1.049. Then this factor, times the desired diameter (d) squared, times 64.3, equals the given volume 255 cu.ft. per minute. Solving, $d = 1.95$, or, say, 2 in.

Having found the diameter of the bell-shaped orifice, it may be designed from the proportions given in Fig. 3.

The diameter of a thin-plate orifice may be found from that of the bell-shaped orifice, the squares of the diameters being inversely proportional to the coefficients of discharge. For example, the diameter of the bell-shaped orifice = 2 in. and the coefficient of discharge 0.98. The coefficient of discharge of a thin plate being 0.64 let d_t be the diameter, then $\frac{d_t^2}{2^2} = \frac{0.98}{0.64}$, from which $d_t = 2.48$ or, say, 2.5 in. The thin-plate orifice used was a round hole bored in the center of a $\frac{1}{8}$-in. brass plate.

To facilitate obtaining the quantity of air, charts may be made for sets of constant conditions as shown by Fig. 4. This chart is for the following constants: Barometer, 26.5 in.; atmospheric temperature, 60 deg. F.; meter temperature, 100 deg. F.; and for a thin-plate orifice with diameter of 3.3 in., air weighing 0.0676 lb. per cubic foot. The flow formula may be reduced to the form $W = 0.2413\sqrt{h_w(2.6h_w + M)}$ where M = 2,014 for static pressure of 1 lb. per square inch;
= 2,158 for static pressure of 2 lb. per square inch;
= 2,446 for static pressure of 4 lb. per square inch.

By placing a bell-shaped and thin-plate orifice in series and taking simultaneous readings, we have found that for the prevailing pressures (1 to 4 lb. per square inch), the coefficients of discharge for each type of orifice as used above gave identical results.

These meters as made up here have cost from $25 to $35 complete, and on an average the total cost installed has been around $50 apiece. They have given satisfactory service, have been reasonable in cost, and positive in results.

In operation we have found that the air should be regulated ahead of the meter, and that care should be taken that water and dirt do not collect in the air lines to the manometers.

Determination of Chromium in Chromite

One gram of the finely ground chromite is heated with 8 g. of sodium peroxide in a covered porcelain crucible for fifteen minutes, avoiding fusion, according to A. Franke and R. Dworzak in *Zeitschrift der angewandten Chemie* (abstracted in *Chemistry and Industry*). The mass is then just fused, allowed to cool, and extracted with boiling water. After boiling for ten minutes the solution is acidified with sulphuric acid and filtered into a 500-c.c. graduated flask; 100 c.c. of the filtrate is treated with 25 c.c. of 5 per cent ferrous sulphate solution and 5 c.c. of sulphuric acid and the excess ferrous salt is titrated with permanganate to the first visible color change. The permanganate is preferably standardized against potassium dichromate, as the iron or oxalic acid figures give slightly low results. Good results are also obtained by the iodometric method provided the alkaline chromate solution is evaporated to dryness, after filtering off the bulk of the iron, so as to render the last traces of iron insoluble. The presence of this iron in the filtrate is the cause of the slightly high results that are obtained usually by the determinations according to this method.

Discussion

"Engineering and Mining Journal" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief. Letters will not be printed unless the author's name and address are known to the editor.

The Necessity of an Objective

THE EDITOR:

Sir—Three articles appearing in your estimable publication, which at first glance appear to have no direct relation, deserve a little fuller discussion, even though it be fruitless. I refer to editorial page 513, issue of March 27, "A Lack of Co-operation in Canada"; "Discussion," page 892, issue of May 29, "Why He Discontinued"; and editorial page 1033, issue of June 26, "Red-blooded He-men from the Mines."

With regard to any lack of co-operation, especially with regard to "The Institute," venerable and eminently respectable institution, one does not have to scan history closely to find that, whether it be a nation, a church, or various organizations within these two bodies, having bearing on economic or spiritual issues, the lease on life of any of them depends to a large extent on the creation and maintenance of live issues and objectives. The fathering of such objectives and issues, and principally their clear and concise presentation to the members comprising the body of the organization, lies with the directing officers of the organization.

It seems to be a common fallacy of belief that ideas do not react to the elementary laws of physics, and that a single idea promulgated in an organization will in some miraculous manner carry on, and gather momentum, without any further internal effort. While any intelligent member of any organization will deny this, one has only to ask the direct question, without preliminary, "What are the aims and activities of your society?" and one will either meet with silence or with a reference to the constitution and by-laws, which are buried as deep in the obvious aims of the society as the cornerstone of a building, and no more apparent. The trouble with practically all societies, churches, and nations is decay. This decay is the direct result of the complexity of modern practice, resulting in the inability of the average man to obtain a mental focus on any real aims or objectives, and through the failure of those responsible to pick out from the innumerable issues and objectives of modern practice a few of the more important, and present them in a manner both clear and interesting.

I have had direct dealings with the Canadian mining industry, or that part of it within the range of my endeavors, for a period of about fifteen years. In that time it is my experience that not once have I seen an instance where "The Institute" has had any real contact with, or effect on, the said industry. I say this at the risk of drawing down the wrath of certain people, even though it be intended as a constructive criticism. Some gentlemen may point out that the various meetings of the Institute afford this means of "contact." But I would point out that these meetings are more available to the geologists and professors referred to in the editorial of June 26, than to the larger body of "Red Blooded He-men," who must necessarily comprise the body of any organization, and furnish by their financial donations the means for the furtherance of the *aims and objectives* of the Institute, when and as presented. When many correct their views and through proper guidance attend "conventions" with a clear idea that the convention is to deal with business related to the organization, or to which the organization is related, and not an intersectional golf match in the day time and a testing of the relative merits of the stocks of local bootleggers—then and not till then will some of the decay be cut away from many organizations. That happy day cannot possibly arrive until organizations are able to produce officials who will be able to present to their members ideas in a clear and concise manner which will stimulate their interest and have a direct bearing on the aims of the society.

In your issue of May 29 "A Prospector" states, in more general terms, what is applied to "The Canadian Institute of Mining and Metallurgical Engineers" in the first instance. It might be summed up as follows: "What's Wrong With Everything?" May I suggest a few other "discontinuances":

1. The Editor of *Automobile Journal.* Dear Sir—Please discontinue my subscription to your paper. Before purchasing an auto, I was an enthusiastic automobilist. Everyone seemed to be going somewhere, or coming from somewhere, and generally enjoying himself in an auto. So I bought a Ford, from a junk dealer who let me have it cheap. But the tires lasted only about 100 miles; then the oil all used up in the crank case and burned out the bearings; the battery ran out of water and spoiled; and then one wet night the durn thing skidded off a bridge and went into the river, and nearly drowned me. So I have given up automobiling, and taken a job washing cars in a local garage, where I can watch others have hard luck like myself.—EX-AUTOMOBILIST.

2. The Editor of *Field and Stream.* Dear Sir—Please discontinue my subscription to your paper. I have been very interested in *Field and Stream* for some time, but though I fish like you say to fish, hunt like you say to hunt, and trap like you say to trap, I just seem naturally out of luck, so I am quitting the sport, and have taken a job in a local fish and game market, where fish and game come in without so much effort.—EX-SPORTSMAN.

3. The Editor, *Ladies Home Journal.* Dear Sir—Please discontinue my subscription to your paper. I have been interested in your *Journal* for some time. Especially the sections devoted to interior decoration, exterior finishes; and palatable cookery. But somehow or other I have such hard luck that I can't earn enough dough to follow out even the simplest ideas as set forth in your paper. So me and my wife and five children are giving up housekeeping, selling our equity of $200 in our home, and going out as caretaker on a ranch, where all our grub and clothing will be given us regular and sure.—BENEDICK.

It will be easily possible for the reader to fill out a list of discontinuances, covering all branches of endeavor and walks of life. CONTEMPORARY.

Keithley Creek, B. C.

News of the Week

The Mining News given in ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

CANADA enforcing gas-wastage regulations—Delay experienced in building Rouyn railway—Vipond will increase capital — Development at Waite-Montgomery curtailed.

Michigan begins survey of copper-mining and milling methods; mining industry to be featured at State Fair—South Lake assessment suit postponed.

Italy promulgates new iron and coal regime—French mineral production increases—European steel entente in process of formation.

Idaho Copper Corporation overruled in U. S. District Court—West Kootenay begins construction of third large power plant.

California towns endangered by fire — Randsburg mines active.

Water supply for Tonopah-Belmont assured—Tonopah Divide to increase capital stock—Thompson smelter at Wabuska started Aug. 10.

Silver-lead ore discovered at Ahtell Creek, Alaska; Golden Center, at Candle Creek, reports $27,700 yield in twelve days.

Lane-Rincon, Mines, Inc., resumes operation with increased capacity—A. S. & R. Co. employees at Asarco, Mexico, protest closing of smelter.

Chilean nitrate producers seek means to compete with synthetic nitrates—Bannockburn properties in Ontario under development.

Chief Consolidated Mining Co. operating at Eureka, Utah, increases production.

Arizona Copper Companies Benefiting from the Use of Water-Power

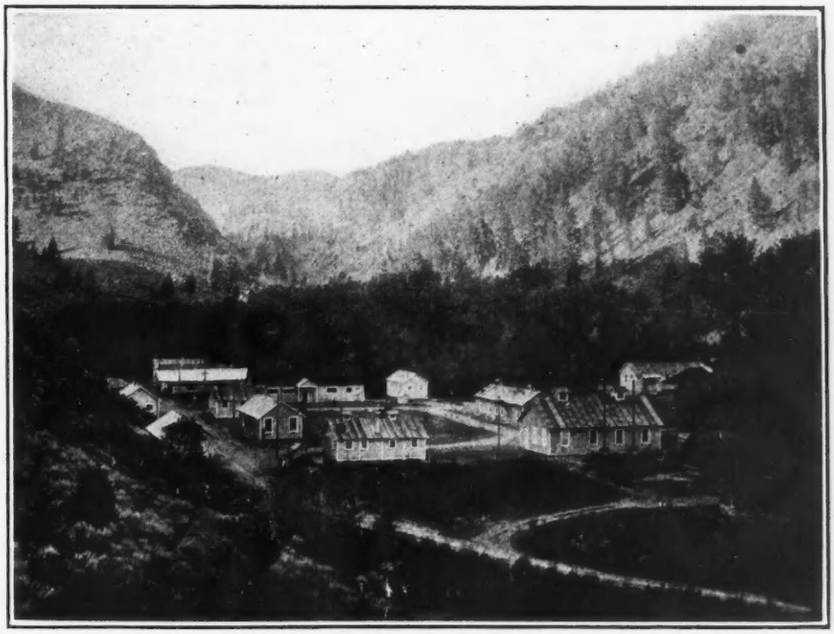
The construction of large dams at natural reservoir sites, and the consequent erection of hydro-electric plants, is proving of material benefit to Arizona copper companies in that they are able to obtain electric power at reasonable rates.

Fossil Creek Dam, on the Verde River, supplies power to the United Verde Copper Co., the Walker mine, and other properties near Prescott.

The dams at Walnut Creek and Frog Tanks, on the Hassayampa, when completed will make power plentiful near Congress Junction and Wickenburg.

Among the major installations are those along the Salt River, which already supply power to the properties in the Globe-Miami-Superior mining districts. Two power plants are operating at the Roosevelt and Mormon Flat dams and a third plant is being installed at the Horse Mesa Dam. The power from the last named will be used exclusively by the leaching plant of the Inspiration Copper Co.

The Coolidge Dam, which is only 20 miles from Globe, on the Gila River, is to be erected at a cost of $3,000,000. It will ultimately furnish additional power, although primarily it is being constructed for irrigation. The Hayden plant of the Ray Consolidated Copper Co. is supplying power for construction work, thus saving the government the necessity of spending approximately $150,000 for a temporary power plant. The enormous power resources of the Colorado River have, of course, not as yet been touched.



Mine camp of the Ford Motor Co., Clayton, Idaho

Ford's Red Bird Mine Active

The accompanying photograph shows Henry Ford's Red Bird camp, Clayton, Idaho, looking north up the gulch of Squaw Creek. On the right is the hillside on which and in which all work has been carried on. The portals of the various tunnels, especially that of the 900 ft. level, are obscured by the trees in the foreground. However, the camp itself will give some idea of the extent of the Ford operations. The Hecla Mining Co. of Wallace, Idaho, has the South Butte property, about two miles south of the Red Bird. The Golden Center Mines Co. controls the Dryden properties three miles south of the Red Bird. The Livingston mine, in which rich lead ore was encountered a few months ago, is twelve miles south of the Red Bird mine. All of these properties are active on development work, and the Livingston mine is making regular shipments of galena while carrying on development work.

Mason Valley "Blows in" Thompson Smelter at Wabuska, Nev.

It has been announced by George A. Kervin, general manager of the Mason Valley Mining Co., that this company started its Thompson smelter at Wabuska, Aug. 10. This company owns the Mason Valley and Bluestone copper properties and an 800-ton flotation plant near Mason, Nev.; the Thompson smelter, at Wabuska, Nev.; and has a lease on the Balakalala copper mine at Coram, Calif. Sulphide ore is derived from the Balakalala mine and 150 tons of ore per day is being shipped to Wabuska.

Ore buyers have been in the field for the last several months, and there is estimated to be over 15,000 tons of ore in the smelter stockpiles.

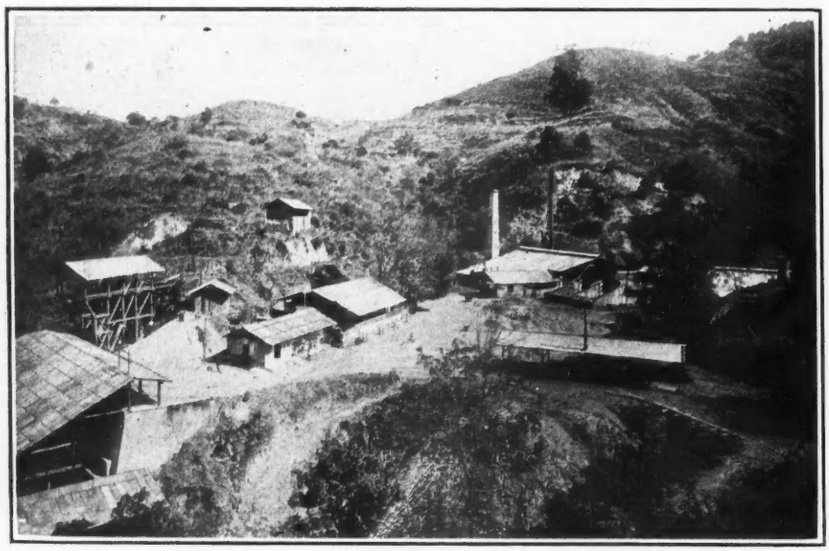
The mines at Mason Valley produce siliceous oxidized ore and sulphide concentrate. The smelter is to start on a 700-ton daily basis, and tonnage will be increased as conditions warrant.

Silver-Lead Deposit Discovered on Ahtell Creek, Alaska

According to Carl S. Whitham, of Chisana, Alaska, a silver-lead region which seems both important and extensive has been discovered on Ahtell Creek, Alaska, about 70 miles east from Gulkana. It consists of two separate vein systems about 7 miles apart. Six miles up Ahtell Creek, from the Copper River, at an approximate elevation of 2,500 ft., three quartz veins are exposed along the side of a small gulch. One vein is 12 ft. wide, with quartz-calcite gangue, and carries galena throughout its entire width. The vein strike is N. 60 deg. W. (magnetic). Thirty feet east of this vein is a vein three feet wide which carries some galena, but the principal mineral is tetrahedrite. The strike of this vein is N. 89 deg. W., nearly vertical. About 20 ft. further east is a quartz vein 30 to 40 in. wide that carries galena and gray copper. The wall rock of all three veins is an altered diorite impregnated with pyrite.

Seven miles further up Ahtell Creek at about 3,000 ft. elevation is another mineral zone, the outcrops of which consists of five veins from 18 in. up to 8 ft. in width, carrying silver-lead minerals. One vein is 6 ft. wide and carries considerable galena. The strike is N. 40 deg. E. About 150 ft. west of the above is a vein 30 in. wide containing chalcopyrite. A vein 3 ft. wide carrying galena lies 60 ft. further west and has a strike of N. 20 deg. E. An 18-in. galena-bearing quartz vein outcrops about 300 ft. further west and a fifth vein 8 ft. wide is exposed about 200 ft. west of the above 18-in. vein exposure. They occur in a sheared zone in the diorite and contain some lenses of solid galena of considerable size. Galena float has been found in several gulches many miles apart, indicating a possible silver-lead district of great extent.

The Alaska Road Commission is at present extending a motor road from Gulkana which will tap this section and make available transport facilities through Gulkana to the Copper River and North Western R.R. at Chetina.

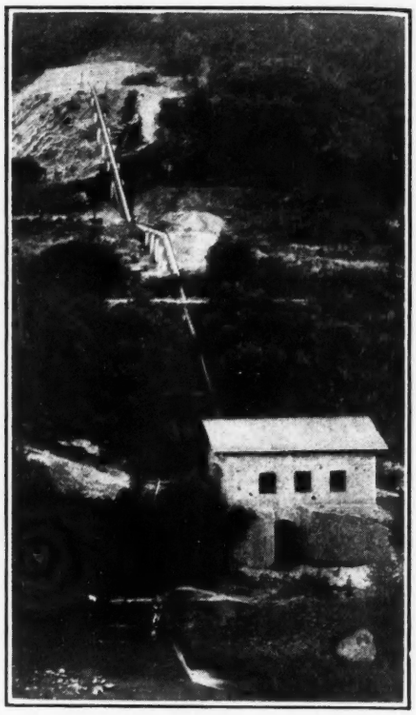


Part of surface plant of Lane-Rincon Mines, Inc.

Lane-Rincon Resumes Operations with Increased Capacity

The Lane-Rincon Mines, Inc., Temascaltepec, Mexico, has recently increased its flotation plant capacity to 150 tons per day. The present management secured this property in 1905, and in 1915 it was raided and wrecked by General Zapata, after which the mine filled with water. All damage to the plants has been repaired and pumps have been at work for months dewatering the mine. The enlarged mill began operation July 26. Ample cheap labor is available; agricultural products are plentiful and cheap; the climate is unexcelled, and hydro-electric plants furnish an abundance of power, all of which results in low-cost production.

Workings in the mine aggregate 45,000 ft.; the deepest is 400 ft. in the Rincon mine and 600 ft. in the Arriba. Thus far little work has been done below the permanent water level. All of the workings of the early Spaniards were above the water level. The records show a total production of silver to 1915 of $11,000,000 gold value. Blamey Stevens, Temascaltepec, Mexico, is mining engineer in charge of operations. The photograph presented above shows one of the hydro-electric plants and the other shows the machine shop, foundry, and other mine buildings. A corner of the flotation plant is shown in the lower left hand corner of the larger illustration.



Lane-Rincon hydro-electric plant

Lead-Silver Ore Discovered in Alkali Springs District, Nevada

A discovery of lead-silver ore has been made on the Easter group of claims, in the Alkali Springs district, about 18 miles southerly from Tonopah, Nevada. Values occur over a wide area in a locality partly covered by wash. Examining engineers have commented favorably on its possibilities.

Practically no development work has been accomplished to date, but the High Divide and Thompson Divide companies recently secured a lease and option on the group and have started shaft sinking and surface trenching. Terms of the option are a purchase price of $12,000 cash and 120,000 shares of stock. Of this amount $6,000 cash and 60,000 shares of stock are to be paid within four months from the date of the option and the balance is to be paid within eight months.

Maxville Gold Contracts for Flotation Equipment

The Maxville Gold, Silver, Mining & Development Co. has given a contract to the Butte Machinery Co. for most of the equipment for its 100-ton flotation plant, and machinery will be installed immediately, close to the mouth of the mine tunnel at Maxville, Granite County, Mont. The mill will be constructed under the supervision of J. V. Quigley, engineer for Minerals Separation Co.

Otisco Mine, Near Butte, to Be Opened

Adolph Lewisohn, of New York, and interests identified with him have taken a bond and lease on the Otisco properties adjoining the Butte Copper & Zinc Co. mines in the Butte (Montana) district. These properties, which have been under option to Messrs. P. H. Kenny and Glenn Anderson for some months, were recently taken over by a New York company through Kirby Thomas. Subsequently the Lewisohn interests acquired the contracts and options. The Otisco workings are now being unwatered preparatory to development and operation.

Report of Second Strike at Cananea Denied

Reports of a second rich ore strike at the Cananea Consolidated were denied recently by officials of the company. The first ore strike disclosed by drill holes was located near Democrata Gulch and is expected to add materially to Greene's commercially mineralized ground. Additional churn drillings are reported to have disclosed the porphyry zone to be larger in size and with better assays than preliminary operations showed. Greene-Cananea has finished its construction and expansion. During war time, the plant and equipment were pretty much used up. Immediately after the armistice a program of upbuilding and modernization began, and in six years it is said to have depleted quick net assets from $7,000,000 at the end of 1919, to $3,108,000 at the end of last year. Current production it is understood was close to 17,000,000 lb. for the first half of 1926. Average costs are around 10c. a pound, including all charges except depletion.

Century Zinc Completes Mill

The Century Zinc Co. has completed its new Bingham mill on a lease south of Baxter Springs, Kan. The lease has been drilled, with several holes put down to the 400 level, and the company believes it has a mine that should prove as good as the Malsbury, located directly to the north and which has been a fine producer. A sheet-ground formation has been developed at the lower level, with soft ground at about the 200 level.

Water Supply Assured for Tonopah-Belmont

Sufficient water supply for Tonopah-Belmont company milling operations at Hamilton, Nev., has been secured by a fifteen-year agreement recently signed. Water will be secured from the California mill springs, to which a four and a half mile pipe line to convey water to the storage tank is being built. The 9,200-ft. aërial tramway from the portal of the Cornell tunnel down the hill to the mill has been completed with the exception of stringing the cable. Work on the power plant has been finished and construction of the 75-ton mill will be completed late in August.

The Cornell tunnel is being driven to connect with the workings of the Nevada mine to transport ore to the mill from the mine, in which a considerable quantity of silver-lead ore is said to be blocked out. The Cornell property, was recently purchased to furnish better working facilities at the Nevada mine. Three high-grade lead-silver veins have been cut in extending the Cornell tunnel.

Employees of A. S. & R. Co. Petition for Continuance of Smelter Operations

No action has as yet been taken by the Mexican Government on the petition of smelter employees of the American Smelting & Refining Co. at Asarco, State of Durango, that that company be required to continue the operation of its smelter there. Because of the fact that the mines from which the ore supply of the plant was obtained were practically exhausted the company decided to suspend operations, at least temporarily. It gave the thirty days' notice as required by law to avoid the payment of full-time wages to the employees beyond the suspension date. Despite this fact the laborers are seeking to compel the company to keep the smelter running.

Many mines in the states of Guanajuato and Jalisco suffered heavy damages by the recent floods. In some localities entire mine villages were washed away, and in other districts mines were flooded.

Mining in Johnson District Revived

It is reported that operations will soon be resumed at the Keystone property, at Johnson, Ariz., and its 350-ton flotation mill will be active in the next sixty days. The camp is about five miles north of Dragoon station on the Southern Pacific, in Cochise County. Rumors are also current to the effect that the Arizona United Development Co. may soon resume operations at its property adjoining the Keystone on the north.

Bannockburn Lead Properties Under Development

Several galena properties situated north of Bannockburn, in Hastings County, Ontario, are undergoing active development. At the Hollandia property work has been in progress for some months. The old reduction mill has been torn down and is being rebuilt and equipped with modern machinery. Prospecting along the vein toward the Roberts property has disclosed massive galena in nearly every instance. The present work at the Hollandia is under the supervision of W. J. Neale, of New York. The Hollandia has also acquired an option on the Crysler property, to the north of its holdings, on which development work will be started soon.

J. G. Martin, of Niagara Falls, N. Y., is developing the Roberts property north of the Hollandia. Recent work on the Blackburn galena property a mile and a half east of the Hollandia has disclosed some good ore, and it is the intention of the present owners to pursue development without delay.

Lower Contact at South Lorrain to Be Explored

The lower diabase contact in the South Lorrain si ver district of Ontario soon will be explored. Theoretically, this geological horizon should be as good as the upper one, which produced the wealth of the district. The location of the lower contact was established by a drill hole put down by the Mining Corporation of Canada and the Keeley company on the line between their respective properties. A 600-ft. winze now is being sunk in one of the lower workings to explore the lower contact.

Reports from Red Lake indicate that every advantage is being taken of the short working season. Though the workings of this summer have developed nothing particularly new, they have not revealed anything adverse.

Work on Bonanza Claims Resumed

B. T. Conkling and his Deer Lodge associates are now operating the Bonanza group of claims, in the Emery district, 12 miles northeast of Deer Lodge, Mont., and one-half mile above the Emery mine. Plans have been laid to unwater the 200-ft. shaft on the property and develop a vein of lead-zinc-silver ore. The electric power line has been run to the property, and transformers, an electric hoist, and a 75-h.p. compressor have been installed.

Tonopah Divide to Increase Capital Stock

Stockholders of the Tonopah Divide Mining Co., at a stockholders' meeting to be held in Tonopah, Nev., on Sept. 20, will vote on a resolution to increase the capital stock from 1,250,000 shares to 2,500,000 shares, of par value $1. The additional stock is to be placed in the treasury to be used as needed, primarily in the purchase of new properties. The company has $140,000 cash in the treasury, which is to be reserved for operating purposes. Tonopah Divide has been developing the old Midway mine, in the Tonopah mining district, for the last two years. Considerable development work has been accomplished on various levels, from the 800 to the 1,600, but no commercial ore has as yet been found.

The Divide mine, 5 miles south from Tonopah, has again been leased to the Ford brothers, the lease to run for one year from July 20. The company has netted a substantial return from the lease operations during the last year.

Manitoba Gypsum to Develop Deposit in British Columbia

Officials of the Manitoba Gypsum Co. have let a contract for the driving of a tunnel to determine the width and uniformity of deposit in the gypsum properties owned by the company in the Warden district of British Columbia. If results are satisfactory, a five-tower aërial tramway will be built to convey the raw material over the Kootenay River to the railway, for transportation to the plant at South Westminster.

News From Washington

By PAUL WOOTON
Special Correspondent

Mineral Statistics Continue to Be Handled by Two Bureaus—Chilean Nitrate Producers Worried

Some disappointment exists in the metal mining industry because of the apparent abandonment of the plan to transfer the minerals division of the Bureau of Foreign and Domestic Commerce to the Bureau of Mines.

Many facts and figures concerning foreign mineral production are of the greatest importance to domestic producers. The Bureau of Mines has a large division engaged in the analysis of mineral statistics. To have the studies of foreign figures and figures handled independently in another bureau leads some to think that the industry may not receive the full benefit from data being gathered in its interest.

Chinese Tungsten Production Increases

China is mining tungsten in larger amounts than had been thought probable at present prices. The veins in Kiangsi province recently had an output in a single month of 800 long tons of ore carrying 67 per cent of WO_3, according to information reaching the Bureau of Mines. The high price of tin is having the effect of increasing Burma's tungsten production.

Some domestic production of the metal continues in Boulder County, Colo.; at Mill City, Lovelock and Mina, Nev., at Bishop, Calif.; at Atolia, Calif., and at Tucson, Ariz.

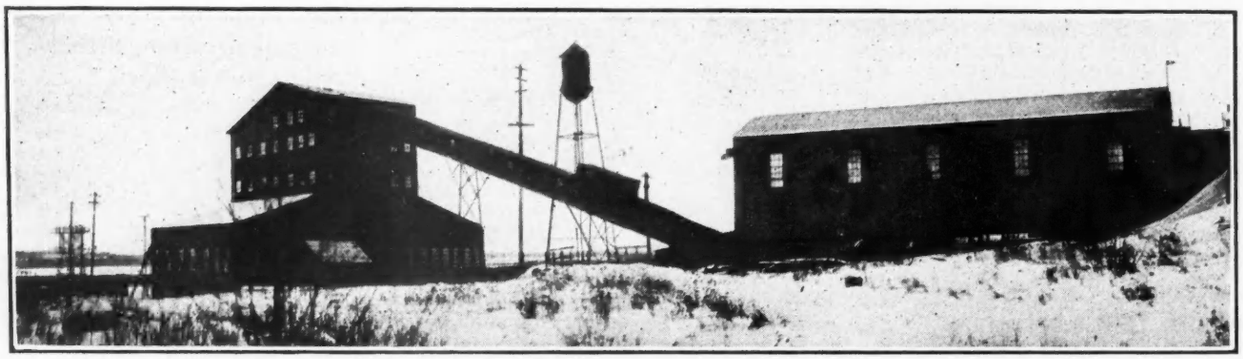
Chilean Nitrate Situation

That the producers of Chilean nitrate are aroused thoroughly to the danger threatening their industry because of the rapidly mounting output of fixed nitrogen is shown unmistakably by the resolutions adopted at the recent conference in Santiago, called by the Chilean Academy of Economic Sciences. The resolution, which leads the list, recites that it has been established that artificial nitrate is being sold in the world markets at prices lower than those asked for the natural product.

The necessity for reducing the price to the point where it can compete with fixed nitrogen is held to be apparent. In order to reduce cost, it is proposed to strive for more effective treatment processes; for economies in the use of fuel; for a wider use of mechanical equipment; for a reduction in the quantity of water used; for improved transportation facilities; for better port handling and lower ocean rates. In order to make the latter possible, it is suggested that the Chilean merchant marine may have to be stimulated.

As emergency measures to meet the existing situation, it is suggested that the export tax be reduced and the unrestricted sale of nitrates by the individual producers be allowed. This latter proposal would tend to concentrate production in the hands of the low-cost producers. It is suggested that half of the sacrifice which is agreed upon should be borne by the government.

The conference was addressed by the Minister of the Treasury. He pointed out that a reduction in the export duty hardly would be granted, but if the industry should show due diligence in effecting economies it may reasonably expect to be relieved of some of the requirements with regard to labor and of the duties recently imposed on coal and fuel oil. It was revealed at the conference that 60 per cent of the industry is in Chilean hands.



Winter view of Hill-Trumbull washing plant, Calumet, Minn. Right: Crushing and screening plant. Left: Washer with tailing pond in distance

Correcting Cargo Iron-Ore Analysis

Since the Hill-Trumbull washing plant at Calumet, Minn., was built, in 1920, trouble was experienced in getting the mine analyses of the cargoes to check with those of the Lower Lake ports. Samples at the mill were taken from the tops of the loaded ore cars, and when the cargo summary was completed it would sometimes differ two points from the Lower Lake report.

To correct this discrepancy the concentrate chute leading from the picking belt to the concentrate bin was changed so that this ore would unite with that from the 25-ft. log washers before reaching the bins. By inserting a steel cup 5 in. in diameter by 5 in. deep in the ore stream to collect a sample after concentrate was added, a result was secured that checked within a half point on iron content with the Lower Lake analysis and gave such a close average sample that no further trouble was had. Where concentrate receiving bins are small and give but little chance to make a homogeneous mixture of the various sizes of ore secured from the different machines this method of correcting the trouble causes little expense and gives average results that can be relied upon.

Central Manitoba May Increase Capital

It is understood that the directors of the Central Manitoba Mines, Ltd., control of which lies with John Taylor & Sons, of London, are considering a public issue of the stock. The company was recently reorganized to take in additional valuable territory and the capital is increased to $4,500,000. To date approximately $600,000 has been spent on this property and a considerable amount of ore has been developed. The management believes that developments have progressed to a point which justifies the erection of a 250-ton mill.

Chief Consolidated Increases Production

Total shipments of ore made by the Chief Consolidated Mining Co. for the second quarter of the current year amounted to 36,953 tons, which yielded after transportation, sampling and all operating charges $148,732, compared with total shipments of 42,757 tons, yielding $115,622, for the first quarter of the year.

Total development footage of 3,860 ft. is an increase of 537 ft. over the quarter preceding. The average net value of zinc-lead ore amounted to $10.67; and of lead and dry ores, $22.75, compared with $11.74 and $15.98 a ton respectively for the same classes of ore during the quarter preceding. Metal content of the ores aggregated 2,041 oz. of gold; 702,898 oz. of silver; 7,893,979 lb. of lead, and 3,698,639 lb. of zinc.

The net operating income for the first six months of 1926 was $393,267, while the net income was $372,214.

Survey of Michigan Copper Mining and Milling Methods Begun

Exhaustive surveys of milling and deep-mine practice have been started in the Michigan copper district by engineers of the U. S. Bureau of Mines, in co-operation with the mine operators and the Michigan College of Mines.

The survey of mining methods will be directed by Dr. W. R. Crane. W. H. Coghill, a specialist in concentration, will direct the milling survey.

Dr. Crane came to the Michigan district from Birmingham, Ala., where he made an exhaustive survey of mining practice. His major study in the Michigan district with respect to deep mining will be the problems of roof supports, settlements, and disturbances.

Mr. Coghill has made a special study of concentration problems and practice in the mining industry in the United States. For the last five years he has made his headquarters in the Tri-State district, where he worked out problems of much importance to the lead and zinc industries.

Mohawk Has Complete Regrinding Equipment

All four heads in the Mohawk stamp mill at Gay, Mich., now are equipped with regrinding units, the fourth unit having been completed recently. The regrinding of tailings saves one pound or more of copper per ton of rock. Mohawk yield continues high, now averaging 26 lb. per ton of rock stamped. The stamp mill is not quite up to capacity, but the high average return is sufficient to break production records. Mohawk this year should produce 18,000,000 lb. of metal, compared with 16,400,000 lb. in 1925.

Seneca, near Mohawk, Mich., has put a new compressor in operation, which gives it capacity for twenty-five more drills. Another new compressor will be commissioned in the fall.

South Lake Assessment Suit Postponed

Arguments in the suit brought by South Lake against delinquent Michigan stockholders for collection of assessment have been postponed in the circuit court at Houghton. There is considerable interest in the case, for it is the first time a suit of this kind has been instituted in the Michigan copper district. Heretofore, forfeiture of stock has been regarded as sufficient penalty for delinquency.

West Kootenay to Construct Third Power Station

The West Kootenay Power & Light Co., the power subsidiary of the Consolidated Mining & Smelting Co. of Canada, has started the preliminary work on an entirely new installation, at the point where the Kootenay River enters the Slocan pool. The chief work of construction will start in the early winter, when the flow of the river diminishes, and will be carried on during the winter. This will be the company's third power station on Bonnington Falls.

It is expected that the third 20,000 hp. unit at Lower Bonnington Falls will be put into operation during September, and this will bring the capacity of the two existing stations up to 94,000 hp. No announcement has been made as to what the capacity of the new station will be.

Canada Endeavors to Prevent Wastage of Gas

The Mines Department of the Canadian Government has drawn attention to the regulations to prevent wastage of natural gas, with particular attention to the petroleum drillings in Turner Valley, Alberta. In the event of natural gas being discovered in borings the lessee is bound under penalty of forfeiture of his lease to control the escape of gas and to have the necessary appliances on hand in the event of emergency.

The lessee is permitted to install an absorption plant for the extraction of petrol spirit, provided a market for industrial and domestic purposes can be found for the residual gas, but under no conditions is the lessee permitted to waste the residual gas. Several wells sunk in the Turner Valley have through carelessness permitted the waste of millions of cubic feet of gas daily, to the detriment of the whole field.

Michigan Mining Industry to Be Featured at State Fair

In conjunction with the Michigan department of geology, the Michigan College of Mines, Houghton, will present a comprehensive educational exhibit of the copper and iron mining industries of the Lake Superior district at the Michigan State Fair at Detroit in September. The mining companies have offered their co-operation in furnishing materials, and many of the companies will supply large photographs to show the various operations in mining and concentrating. The exhibit will not only aim to show the processes connected with the industries but will indicate the dependence of manufacturing in the central west on copper and iron from the Lake Superior region.

Golden Center Dredge Yields $27,700 in Twelve Days' Operation

At the Golden Center Mines, Inc., a placer gold property, operating at Candle Creek, Alaska, dredge No. 1, capacity 1,200 yd. per day, was placed in operation the middle of July, and during twelve days recovered $27,700. Dredge No. 2 will be placed in operation soon.

According to C. L. Hershman, consulting engineer for the company, who is in charge of operations at the property, the dredge recovery fully substantiates the reports of Edward E. Pierce, E. G. Linscott, E. J. Mathews, and reports of the U. S. Geological Survey, which indicate the gravel available in the main channel of Candle Creek to be approximately 25,000,000 cu.yd., averaging above $1 per cubic yard. The gravel at Nome averages 30c. per cubic yard. The company proposes to install additional dredges next year to increase the production up to 10,000 cu.yd. per day.

Mass copper at Quincy Mine weighing ten tons

Quincy Mine Photographed for Copper Story

A copper mass weighing more than ten tons, at the 81st level of No. 2 shaft of the Quincy mine, at Hancock, Mich., was recently photographed by U. S. Bureau of Mines men who are engaged in filming "The Story of Copper." Views of other underground scenes in Quincy have been taken at a depth of over a mile below surface. Photos of men in man-cars ascending the shaft and of the famous hoist at No. 2 shaft also have been obtained. The hoist, which has a capacity of 13,500 ft., is the largest drum hoist in the world.

Ardsley Unwaters Old Shaft

The Ardsley Butte Mining Co. is going over equipment preparatory to unwatering its 625-ft. shaft on the "Belgrade" claim, near Elk Park, Mont. The shaft has been equipped with an air lift to handle the water to the 400 level, after which sinker pumps will finish the work. An electric station pump, which is on the ground, will be installed on the 600 level.

Italy Promulgates New Iron and Coal Regime Under Mussolini

Shortage of Labor—Tunisian Phosphate Production Declines—Lead Mines Opened in Brittany

By Francis Miltoun Mansfield

Special Correspondent, Paris, France

WITH a view to developing the iron and steel metallurgical industry within the country the decree of the Italian ministerial council of June 30, 1926, provides for the development of the Italian lignite fields of the Val d'Arno, Sienna, Ribolla, Pacinello, and Campagnatico districts by the Ilva combination and other iron and steel plants, whereby pulverized fuel is to be utilized in the furnaces by application of the Stein process. The Terni establishment is likewise to make use of the deposits at Spolato to the same end. To a considerable extent this will supposedly supplant the use of the poor coke produced from Italian carbon deposits.

The ministerial decree referred to was instituted that Italy might be as free as possible from importations of iron and steel from abroad. Consumption was 725,000 metric tons in 1925, of which, including pig iron and semi-finished steel products, 265,000 tons was of home production, the remainder being imported, chiefly from France. The government has loaned the Ansaldo-Cogne company, utilizing the high magnetic ores of the Val d'Aoste, 55 million lire and the Venezia-Juliana establishment 35 million lire. Italian reserves of iron ore are estimated at 35 million metric tons, of which something like 50 per cent are in the Cogne district of the high Alps near the Swiss border, where extraction is now about 200,000 tons per annum. Other native ores, of Sardinia and Lombardy particularly, are also being drawn upon, but it is proposed to conserve those of Elba for future unexpected need should that occasion arise. The Italian Government council and industrial magnates, in a later conference, agreed to modify this ruling if it was found that Elba ore would save the situation to the extent that Italy would become entirely free and independent of outside sources of supply of mineral. The first and final object of this new movement is that Italy shall be able to keep as much of her cash at home as possible.

Developments in Asbestos

Italy has well-known and recognized deposits of asbestos, in the island of Sardinia. The Cave di San Vittore Co. is exploiting an asbestos mine and has a project in hand for the production of asbestos industrial materials in all lines. The company has just increased its capital from 6 million lire to 15 million. Equipment for handling and fabricating this mineral has been installed which will be able to treat 2,000 metric tons per day, the present facilities in Italy not exceeding 600 tons.

Mine production has been reduced by a lack of labor, which seems an anomaly, since one of Italy's chief exports is labor. Pyrites produced by the Montecatini company amounted in 1925 to 372,340 metric tons, compared with 373,215 tons the year previous. Sulphur extraction amounted to 50,114 tons, against 42,221 tons. This could have been increased but for the labor shortage. The company is treating the bauxites of Istria for the production of aluminum, an industry which is developing fast in Italy. The Montecatini group is producing 18,000 tons of the Italian production of 25,000 tons of synthetic ammonia. Profits for the year were 95,337,595 lire, of which 26,603,110 were passed to dividend account on the basis of 18 per cent. Taxes paid amounted to 17,941,133 lire.

Phosphate Production of Tunisia Declines in 1925

The French protectorate of Tunisia produces certain quantities of mineral of which the bulk is exported to mainland France. Phosphates in particular are meeting the competition of Moroccan phosphates, also under the control of France, which accounts somewhat for the falling off of the figures (2,691,000 metric tons) in 1925, compared with 2,862,000 tons for the previous year. It is considered that the falling off in production is largely accounted for by the lack of common labor. The remarkable fact concerning the shortage of labor is the more apparent in that this native labor is being daily imported into mainland France for absorption in the heavy industries, thus leading one to think that Tunisian labor is not what it might be, or that not sufficient use is made of mining machinery, the latter being probably the more nearly true. The American consular offices in Tunisia might throw some light on this point and suggest a way to American manufacturers wherby they might introduce up-to-date American mining machinery.

French Mineral Production Increases

Figures for April indicate that French mineral production is steadily increasing. Iron ore was recovered to the extent of 2,979,986 metric tons, with stocks on hand amounting to 2,288,509 tons, with Germany and Italy the chief buyers among foreign countries. April production of potash salts in France was 101,402 tons; bauxite, 38,600 tons; iron pyrites, 16,060 tons; rock salt for sodium products, 117,350 tons.

Switzerland Discovers Iron Deposits

There have been discovered in the Canton of Argovie, Switzerland, deposits of iron ore over an extent of a thousand acres, with beds running from six to fifteen feet in thickness. It is believed that these deposits will ultimately be found to extend to more than double the area specified. The thousand acres referred to are estimated as representing 266 million metric tons of mineral, with a tenor of 30 to 40 per cent, estimated as the consumption of Switzerland for a period of seventy-five years. Switzerland possessing no coal, it is proposed to develop the electric furnace.

Lead Mining Development in Brittany

Apart from the old Thyssen iron mines of Normandy there has been little mine exploitation in northwestern France. It is worthy of note that the ancient lead mines of the department of the Cotes du Nord, in Brittany, are now under an intensive exploitation. The first year's exploitation brought to the surface 1,080 tons of mineral with a lead content of 71 per cent, containing also 680 grams of silver to the ton. The present season is supposed to put the property on a paying basis. The washing plant is being doubled, and lodgings for the workers are being erected at the mine.

Idaho Copper Corporation Overruled in Action Against Inspector Campbell

The answer of Stewart Campbell, state mine inspector for Idaho, is allowed to stand in the suit for $500,000 brought against him by the Idaho Copper Corporation. This appears in the decision of Judge F. S. Dietrich of the United States District Court at Boise.

It is understood that this decision prevents further delay in having the case set for trial at an early date. The case followed a report on the company, having property in southern Idaho, made by Inspector Campbell a year ago or longer. Into it the name of George Graham Rice was brought. On May 5 the plaintiff discontinued its suit for $100,000 against Mr. Campbell and filed one for $500,000 on the following day.

Progress in Negotiations for European Steel Entente Reported

Negotiations for a European steel entente, including France, Germany, Belgium, and Luxemburg, are understood to be making good progress, according to the U. S. Department of Commerce.

England is reported outside of the entente because of failure to agree on production quota. The German Government, it is said, favors participation on the part of its rail industry in order to recover its foreign markets at higher prices, and it is reported that France desires to maintain its expanded trade at the higher price levels which will prevail under the entente.

Belgium is also said to look favorably on an entente, but the Charleroi producers present an obstacle to a final consummation thereof by disputing their production quota. The general basis for the entente involves production quotas on steel ingots for each country, with complete freedom regarding tonnages sold abroad, provided the prices determined upon are maintained. It is generally agreed that this will result in substantially increased prices on foreign sales.

London Letter

By W. A. Doman

Special Correspondent

East Rand and Cinderella Consolidation Near Completion

London, July 27.—Provided all parties agree, the East Rand Proprietary Mines-Cinderella Consolidated negotiation should soon reach consummation. There are powerful interests behind it, for the Central Mining Corporation and the General Mining Corporation each guarantee 40 per cent, and Barnato Brothers 20 per cent, of some half million 10s. shares to be offered for subscription at 10s. 6d., and they have an option for two years over a further 500,000 shares at 12s. 6d. per share. With the success of the West Rand Consolidated reorganization still fresh in their minds, the public will doubtless readily take the shares. The E.R.P.M. absorbs the Cinderella, and the capital of the combined areas is to be £1,500,000. The Cinderella debentures are wiped out by shares and cash. A favorable point is that the Union Government has agreed, if the amalgamation plan is carried through, to release both companies from all liability in connection with undermining rights acquired from it in the past. The main factor is the reduced capital, for regular and substantial dividends could not have been paid on the combined original capitals. Presumably the future will lie with the Cinderella portion, as the E.R.P.M. payable areas are much scattered.

The Indian Copper Corporation has not succeeded in obtaining a loan from the government under the Trade Facilities Act. Plans for financing the company have consequently to be modified.

Report of Kingsley Thomas Criticised

In a previous letter I referred to the report of Kingsley Thomas, the Royal Commissioner appointed by the Western Australian Government to investigate the position of the various mining fields, and to his statement that a combination of properties with a reduction in expenditure would lead to a revival of the industry. A. H. Marker, chairman of the South Kalgurli, at the shareholders' meeting last week criticised this report, and showed the value that could be placed upon it by stating that Mr. Thomas spent three hours on the property, and did not look at the mine or examine the work done underground. This may have been a compliment to the company, seeing that the South Kalgurli is the only dividend-paying mine on the Golden Mile. For six years in succession, and notwithstanding the loss of the gold premium, shareholders have received a return on their capital.

We are now getting well into the holiday season, and the fact is noticeable in the share market. For some considerable time specialties have been pushed up to prices that are quite unjustified. The public was "on the feed," and town speculators and finance companies have disposed of quite large blocks of securities at handsome profits, which in the case of the companies will be reflected in dividend payments later. The inevitable reaction has set in, quotations are gradually falling away, the public will "nurse the baby," and the sellers will spend their profits on the Continent.

Holders of Rhodesia Broken Hill Development Co.'s shares are rather disappointed with the annual report; it does not carry them much further, and the production of zinc is not yet. In fact, twelve months or more must apparently elapse before revenue can accrue from this source. A deposition plant is being erected to yield 15,000 tons of zinc per annum.

Soviet Concessions Yield No Profit

From a conversation I have had today in the City, I gather that people who took up mining concessions from the Soviet Government are regretting their action. The complaint seems to be in connection with the internal and external value of the chervonetz. There is no profit in working the mines.

California Towns Endangered by Fire

Brush and forest fires have broken out at different points along the Mother Lode region of California. The most serious fire was in the vicinity of Sonora. The old mining town of Quartz between Jamestown and Stent was almost wiped out. Only eight buildings are reported standing. Mine buildings and residences of the Dutch mine, on the edge of Quartz, were burned down before C. H. Segerstrom, the present owner, could summon assistance. Residents of Quartz escaped without injury. Loss at the Dutch mine is stated to be $75,000. Fire fighters were summoned from Sonora, Jamestown, and other Mother Lode towns.

Fires in the Coulterville, Mariposa County, Calif., district invaded the old town of Coulterville and destroyed the machine and blacksmith shops and outbuildings at the Potosi mine, office buildings at the Mary Harrison mine, and several buildings at the Molvina mine, all of which mines are owned by the Merced Gold Mining Co. The mines have been inactive and were in charge of watchmen. High temperatures and low humidity have created conditions in the foothill region that have greatly increased fire hazards.

Randsburg Mines Active

Among the mines in the vicinity of Randsburg, Cal., that are active may be mentioned the following: Drifting is being done by the Santa Fe on the 1,100 level to intersect ore opened on the 1,000 level. The Flat Tire continues drifting on the 1,600 level. The Big Four is pumping out the 1,200-ft. shaft, where it is reported a body of ruby silver was encountered some months ago. Sinking from the 900 to the 1,000 level is being done by the Silver Glance, which recently shipped a car of ore. At the Yellow Aster, leasers keep the mill running full time. The Monarch Rand is said to have cut the Fairchild vein on the 700 level. The Cleveland mine, leased by the Gowman Mining Co., recently shipped a car of ore, assaying about $2 0 per ton.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Rouyn Railway Construction Delayed—Vipond to Increase Capital

Much disappointment is felt over the slow progress being made in the construction of the Rouyn railway. The work has been delayed by wet weather and also by the fact that it is difficult to get men, on account of the higher wages paid in the mines. Contracts have also been sublet to such an extent that the work is badly held up. It is reported that arrangements have been made, probably by the Quebec Government and the Noranda Mines acting in co-operation, to bonus the contractors in order to have the work completed within a reasonable time. It is also understood that arrangements have been made to extend the Rouyn branch to the Alderson McKay property. This would leave only a short gap between the Rouyn road and the Kirkland Lake branch of the T. & N. O. Railway.

The Vipond mine, Porcupine, Ontario, will soon increase its capital from 2,000,000 to 2,500,000 shares of $1 par value, according to a recent report. A portion of the 500,000 shares will be sold and the proceeds put in the treasury to replace the capital expenditure due to the enlargement of the mill and to acquire control of the Inspiration property. Some of the stock will be given to the Huronian Belt Co. in exchange for the recent acquired stock of the British Porcupine Mines, Ltd. The last-named company controls the Porcupine Crown and the Thompson Krist property, which adjoins the Vipond on the west. When these arrangements are completed the Vipond will control a total of 440 acres. The treasury will have approximately $300,000 in cash, and with this it is expected that the company will be able to begin the payment of dividends in the early part of 1927.

Waite-Montgomery Curtails Work

At the Waite-Montgomery property only a small amount of work is being done at present, and it is understood that operations will be curtailed until the Rouyn railway is completed. This will permit bringing in heavy machinery and equipment and materials for a concentrator which will have to be erected. It is reported that Noah A. Timmins may exercise his option in the near future. If the option is exercised he will have to form a company, and in this case it is believed that an issue of stock will be made to reimburse him for some of his expenditures, which amount to approximately $600,000. The vendors of this property under their agreement retain an interest and some part of this interest has been marketed in the form of units at a price of $750 to $800. Each unit represents 1/10,000 of the capital of the company to be formed, and this places a value of $7,500,000 to $8,000,000 on the property. Ore reserves are understood to have a gross value of $11,000,000.

Situation at the Mines

By Albert H. Fay
Assistant Editor

THE NON-FERROUS METALS, copper, lead, and zinc, are in a decidedly strong position. However, to keep them in this position it has been necessary voluntarily to restrict output to a certain extent. Especially is this true in the lead and zinc district of Joplin, Mo. The mine and smelter capacity of the copper industry is such that if free rein were given production a surplus of metal would soon exist. Copper refiners are well sold up, and there is evidence of active demand in prospect. The electrical manufacturing industry continues to be a heavy consumer of the metal, and the volume of building and automobile consumption promises to be maintained for some time at least.

The improvement in European industrial conditions may seem disappointingly slow, but the foundation is being laid upon which a structure of greater business activity will soon begin to be built securely and rapidly. To those who make a study of fundamentals, the outlook is declared to be most promising. When the general improvement in European industrial conditions once gets fairly started, there will be a prompt and substantial increase in the consumption of copper, as plans for general extension of electrification are are maturing.

Average Prices, February, 1926, to July, 1926

Period	In Cents			
	Copper	Lead	Zinc	Silver
Average, 1925	14.042	9.020	7.622	69.065
February, 1926	13.999	9.154	7.759	66.773
March	13.859	8.386	7.332	65.880
April	13.706	7.971	7.001	64.409
May	13.599	7.751	6.821	65.075
June	14.656	8.033	7.112	65.481
July	13.924	8.499	7.411	64.793

Copper—Diamond drilling at the New Cornelia property, Ajo, Ariz., has developed a large, new, low-grade orebody, and production now exceeds that of the Calumet & Arizona, the parent company. The Consolidated Copper Mines Corporation, in Nevada, has made a twenty-year contract with the Nevada Consolidated Copper Co., for delivery of 3,000 tons of ore per day to the latter. The lower workings of the Kay copper properties are being unwatered, and the Belmont Copper Co., Superior, Ariz., is developing promising deposits at that place. Howe Sound has brought the Britannia, B. C., plant up to full capacity of approximately 36,000,000 lb. of copper per year. In the Rouyn district, Ontario, development work is showing additional reserves of high-grade ore. In Africa the labor conditions at the Katanga properties are such that it may possibly hinder expansion. One of the handicaps under which the company is operating is the lack of agricultural operations in the immediate vicinity to provide a stable and definite source of food supplies. The new copper export association in process of formation has a membership controlling about 90 per cent of the world's copper production. In South Africa, especially in Rhodesia, Tanganyika, and Portugese East Africa, there is an intensive campaign of prospecting and developing copper properties on a large scale. Many of the concessions embrace 10,000 to 50,000 square miles each. At Cananea, Mexico, the Cananea company has found a new orebody at the Democrata mine. The production is at the rate of about 35,000,000 lb. per year.

Refined copper production in the Michigan district in July is estimated at 14,520,000 lb., of which Calumet & Hecla, exclusive of Isle Royale, produced 8,490,000 lb. Outputs of other mines were as follows: Mohawk, 1,400,000; Copper Range, 2,000,000; Quincy, 1,200,000; and Seneca, 630,000; Isle Royale 800,000 lb. Metal shipments out of Michigan continue brisk. There has been an increase in deliveries to Eastern points and an improvement in export business. Canadian boats were in port in July for export cargoes via Montreal. At the Calumet & Hecla, 300 additional miners were added to the payroll and the company is still advertising for more men. The Keweenaw Copper Co. has enlarged its holdings by several hundred acres recently and may continue development work in the near future.

Gold—Considerable talk has been heard about the passing of production of gold into British hands. It is true that much of the gold now being mined is coming from British possessions, but this is because in America mining costs have risen extensively, while gold has been standardized at $20.67 an ounce. Discovery of gold has been reported at Topley, B. C. In the Red Lake district the prospectors are busy with assessment work, which must be completed by Sept. 1, or claims staked last winter will be forfeited. A number of the older and established mining companies of Ontario are actively conducting exploration work on the claims recently staked. The Golden Horseshoe mine, of Kalgoorlie, West Australia, after a successful life, has been closed indefinitely pending additional financing. By reason of increased efficiency in the operation of the Transvaal mines, lower costs have been obtained, and profits are being maintained as the grade of ore declines. In Alaska the Fairbanks Exploration Co., at Fairbanks, has the construction of a 100-mile ditch well under way for its water supply, and is also conducting extensive drilling operations. It will be about three years before actuai mining can take place. The Yukon Gold Co. closed its ten-year dredging program on Prichard Creek, Idaho, as available gravel became exhausted.

Lead-Silver—In British Columbia, the Consolidated Mining & Smelting Co. has increased its production materially over that of last year, owing to increased activities in the Kootenay district, better concentration methods, and improved conditions at the smelters. Further expansion is planned and under way. The company closes its half year operations with a profit of approximately $5,000,000. The Tyee Copper smelter, at Ladycliff, B. C., is being overhauled and converted into a lead smelter. Necessary concentrating equipment is being installed to handle the lead-zine ores. The mill of the Standard Silver-Lead Mining Co., Silverton, B. C., was recently destroyed by fire. In Utah the International Smelting Co. is developing additional property in the vicinity of Eureka. The other mining companies in the Eureka district are continuing operations at full capacity.

Zinc—In the Joplin district there has been some restriction on production for the last two or three months, with the result that 155 mills are in operation, compared with 186 in January. A number of important sales of mining properties have taken place in the Joplin-Miami district, among which may be mentioned the Premier zinc mines, embracing 80 acres of mineral land, sold to the Chicago Mines Corporation. The American Zinc Co. has purchased the Big Chief mine. In the Coeur d'Alene district, Idaho, definite steps have been taken to provide a fifty-ton electrolytic zinc plant at Kellogg, the building to be done by the Sullivan Mining Co., under the direction of the Hecla and Bunker Hill & Sullivan companies. This makes an available outlet for ore from many of the small mines. The Wrigley mine, on Catalina Island, off the coast of California, recently shipped a consignment of zinc concentrates to Belgium and is now planning to enlarge operations by building a second flotation mill. The Silesian American Corporation has been formed to administer and operate the Giesche zinc mines recently acquired by the Anaconda Copper Mining Co. and the W. A. Harriman interests. The management of the new company will be under the direction of the Anaconda and Harriman groups.

Iron—Iron-ore shipments continue heavy from the Lake region and all open-pit mines are operating at peak capacity. Shipments during July from points in Lake Superior and Lake Michigan to lower Lake ports were 9,999,146 tons, compared with 8,525,063 during July last year, an increase of 1,474,083 tons. Because of the late opening of navigation this year, shipments of ore to date are still below last year's record. The Duluth, Missabe & Northern Ry. was the biggest shipper for the month, with 3,169,415 tons; second honors go to the Great Northern Ry., with 2,505,491 tons. It is expected that the season's shipments will be more than 54,000,000 tons. Industrial conditions in the Birmingham district are such that the iron and steel industry has reached a new high level, with producing mines working up to capacity. Shipments of coal to the Lake district this season have been heavier than usual.

People You Should Know About

George J. Bancroft, has just returned to Denver from examining mines at Creede, Colo.

M. W. Summerhayes has returned from England and is now in Rouyn on examination work.

George A. Packard, mining engineer and metallurgist, is in New Mexico and will go from there to Nevada.

J. J. Beeson, consulting geologist, is in Salt Lake after a week's absence spent in Nevada on a mine examination.

R. J. Ennis, general manager of McIntyre Porcupine Mines, Ltd., is visiting the Red Lake camp, in northern Ontario.

William Otis Hotchkiss was inaugurated president of the Michigan College of Mines at Houghton, Michigan, on Aug. 13.

R. S. Stewart, chief clerk of the U. S. Bureau of Mines Seattle Station, has been transferred to the Juneau office of the Survey.

Charles Hardy, president of the Associated Metals & Minerals Corporation, has left the United States for Europe on a business trip to England and France, and will return in September.

Thomas N. Miller, consulting engineer, of Tientsin, China, left his headquarters in July for an extensive exploration journey in Inner Mongolia on behalf of the Chung Wha Mines Co.

M. H. Kuryla, general manager for the United States Smelting, Refining & Mining Co. at its Real del Monte mines, at Pachuca, Mexico, has been in New York for three weeks, and has now returned to Pachuca.

Rowland King, vice-president of C. M. Fassett & Co., chemists and metallurgists of Spokane, with **Harry Bower,** a mining man of Seattle, is on a scouting and prospecting expedition along the coast in northern British Columbia.

C. E. Addams, mining engineer, has just returned to the United States from making examinations in Mexico and is now on his way to New York, stopping off at Hot Springs, Ark. He expects to be in New York during the month of September.

Arthur W. Stevens, mining engineer, has left Boise, Idaho, for the Middle Fork of the Boise River near Atlanta to look after personal property and will be gone for a week. Upon his return to Boise, he will leave for Pearl, Idaho, to examine the Florence mine.

Lawrence G. Trueheart, formerly connected with the Arizona Copper Co. in Morenci, and latterly a branch manager for the Ulen Corporation, is being transferred from Athens, Greece, where he has been supervising the company's work for the last year, to Brazil.

K. Lundberg, geologist and electrical engineer of Sweden, is visiting the Rouyn gold area of Quebec, with a view of introducing the electro-magnetic system of locating copper orebodies under a heavy overburden, which is said to have proved successful in Sweden.

Colonel Henry H. Armstead, of Spokane, Wash., and Kaslo, B. C., has been elected a director of the *Army and Navy Journal,* Washington, D. C. He expected to leave Washington about Aug. 10 for Kaslo on a visit of inspection to his mining interests in that section.

D. McBride will have charge of the new ore-treatment plant which is under construction as a result of the purchase, by H. B. Thomson, H. Carmichael and associates, of the old Tyee Copper Co.'s smelter at Ladysmith, B. C. The new

D. McBride

addition will be a concentration mill equipped with flotation machines. The company owns mines near by, from which a part of the ore supply for the Ladysmith plant will be drawn.

W. H. Englebright has resigned as general superintendent of the Consolidated Cortez Silver Mining Co., at Cortez, Nev., to accept a similar position with the Betty O'Neal Mines Co., near Battle Mountain, Nev. He was succeeded at the Consolidated Cortez by **James O. Greenan.**

S. R. Capps, of the Alaskan Branch of the U. S. Geological Survey, announces by telegraph that the two divisions of his party (traveling by boat and pack train, respectively) reached Happy River, a northern tributary of the Skwentna, on July 9. Conditions for work were favorable.

L. C. Penhoel, president of the Southwestern Engineering Corporation, of Los Angeles, and a director in the Southwestern Exploration Co., left Los Angeles on July 17 for an inspection of the Cabrita mine, in the Santa Barbara district, State of Chihuahua, Mexico.

Sir Reginald Blankenberg, late acting High Commissioner for the Union of South Africa, in London, accompanied by Lady Blankenberg and daughter, recently arrived in South Africa, en route to Johannesburg. Sir Reginald has been appointed a director of the Johannesburg Consolidated Investment Co., Ltd., (Barnatos').

Sam Hugh Brockunier, an engineer from New York City, formerly engaged in operations and explorations in western Ontario and Manitoba, has completed the examination of the Pettigrew mine, near Port Arthur, for a syndicate represented by Kirby Thomas, of New York. Mr. Brockunier is also making an examination of the Champion mine, at Kenora, and of the Ophir-Coronado group of propertes in the same region for the same interests.

William E. Bleloch, who recently has been instrumental in floating the "Boksburg Gap Co.," to which sympathetic references have been made by the chairman of adjoining gold-mining companies, has been in South Africa since 1889 and settled in Johannesburg in 1894. He was a war correspondent during the South African war and wrote "The New South Africa." The effect of the new promotion has been to revive interest in East Rand companies, particularly such as Rand Collieries and Van Dyks.

J. D. Mertie, Jr., of the Geologic Branch of the U. S. Geological Survey, reports the return of his party to Fort Yukon, Alaska, after mapping an area of 1,200 square miles in the upper Salmon River valley. Mr. Mertie will be in Fairbanks two or three weeks collecting mineral statistics and making geologic investigations. The other members of his party left Fort Yukon on Aug. 2 for Seattle. **Ray Russell,** the recorder, recently suffered a severe injury to his knee, but is able to travel.

A. D. Combe has left Uganda, British East Africa, and will travel overland from Uganda to the Cape via northwest Tanganyika Territory, the southeast Belgian Congo, north and south Rhodesia, and the Transvaal to study the ancient unfossiliferous sedimentary rocks of those areas, with the purpose of comparing these formations with those of Eastern Central Africa, on which rock systems he has carried out extensive and detailed field work. He will visit the principal mineral fields en route. From the Cape he will return to Sydney, Australia.

Obituary

W. L. Morrison, an American engineer, was asphyxiated in the Balmaceda mine, near Chuquicamata, Chile, on Aug. 7, while exploring old workings. Four native laborers were also killed by noxious gases at the same time.

Charles J. Paine, treasurer of the St. Mary's Mineral Land Co., died suddenly in Boston on Aug. 5. He also was president of the Douglass Copper Co., the Houghton Copper Co., and the Pacific Copper Co. and vice-president of the Champion Copper Co. His widow and three children survive.

Oren Barron Smith, for several years general superintendent of mines for the Granby Consolidated Mining, Smelting & Power Co., died at Vancouver on July 28. He was fifty-two years old. Mr. Smith was a graduate of the Massachusetts Institute of Technology. He joined the Granby staff in 1899, was made superintendent of the Phoenix mine in 1904, and general superintendent of the company's mines in 1908. At the time of his death he was general manager for the Gleanor Consolidated Mining Co., which is developing a property adjoining the Engineer mine, at Atlin, B. C.

Societies, Addresses, and Reports

Excessive Taxation Declared a Menace to Rand's Future

President of Transvaal Chamber of Mines Holds That Gold Producers Pay Inequitable Share of Costs of Government

P. M. Anderson, president of the Transvaal Chamber of Mines, believes that the future of the Transvaal gold-mining industry depends to a large degree on the treatment that the industry receives from the government and the country at large. In the course of his address at the annual meeting of members of the chamber, held last spring, he said:

"The value of the mineral output of the Transvaal during the year 1925 was approximately £46,000,000 compared with about £49,700,000 in the previous year. There has been considerable activity during the year in prospecting for minerals, notably platinum. The problem before those who are interested in the matter appears to be a question of marketing rather than of production. The gold output of the Transvaal for the year 1925 exceeded the previous highest figure, that of 1924, by 2,068 oz. This increase is due to the outside districts, as the output for the Rand showed a decrease of 5,699 oz.—a result which would not have occurred but for the shortage of native labor. In spite of this shortage, the quantity of ore milled by Rand companies was nearly 100,000 tons more than in 1924, owing to better efficiency and the diversion of labor from temporarily unproductive work. The yield of gold at standard value was 27s. 9d. per ton, or one penny less than that of the previous year, while working costs at 19s. 2d. per ton show a reduction of 5d., which is a very gratifying result when all the circumstances are taken into account. The dividends declared by Rand companies amounted to £8,157,917 and show a reduction of £1,386,599 compared with the previous year, on account of the reduced sterling price of gold.

"The native labor situation has markedly improved and the cost of obtaining native labor has been further substantially reduced, and the death rate from sickness for 1925 is the lowest yet recorded, being 7.8 per 1,000. The constantly improving efficiency due to better methods and appliances leads to certain amount of misunderstanding with some workmen who are paid by results, or in other words on piece work. The changes in standards required by the progress made are resisted from time to time by some of the men, and a Conciliation Board on the subject is again sitting, this time in connection with a dispute on the New State Areas property.

"During the past session the government passed the Miners' Phthisis Acts Consolidation Act. The principal object of this act was to level up the scales of compensation under the earlier acts to those of the 1919 act, as well as to make certain amendments to the latter act. Up to the end of last year the scheduled mines have paid in compensation to the Miners' Phthisis Board and the Director of Native Labor a sum of approximately £8,500,000. With the passing of the consolidating law, the industry expects and has a right to expect that the continued revision of legislation and the increase of compensation provided by successive statutes will now cease.

"The accident death-rate on the Witwatersrand gold mines for 1925 was 2.40 as compared with 2.63 and 2.59 per 1,000 in the two preceding years; the total deaths being 472 as against 526 and 511 in 1924 and 1923 respectively. Ten years ago, in 1915, the total deaths were 684, so that last year's figure shows a saving of 212 human lives. Falls of ground are still the most prolific cause of fatal accidents, but have shown a steady decrease during the last three years; indeed, last year the total deaths from this cause were fewer than they have been for four years, if the incomplete year of 1922 is omitted. The 1925 deaths from this cause were only five above those for 1920. On the other hand, deaths caused by explosives have increased in recent years; the increase is largely due to drilling into unexploded holes. These accidents, due to explosives, are receiving serious attention, and figures relating to such accidents are periodically brought to the notice of managers. Posters and warning notices dealing with the subject of explosives are issued to white and native employees, new methods of working are being carefully studied, and, with the co-operation of all concerned, it is hoped to reduce accidents considerably in th near future.

Silicosis Seems on Increase

"Probably the most interesting of the returns made are those relating to new cases of silicosis and tuberculosis among the miners. For the period ended July 31 last there were 428 fresh cases of simple silicosis (all but one being the ante-primary stage), 28 of tuberculosis with silicosis, and 18 of simple tuberculosis; the corresponding figures for the previous year were 319, 20, and 11. It must be admitted that this apparent increase of disease production, under all three headings, is disappointing. Inquiry shows, however, that of the 428 cases of simple silicosis only two were in miners who had passed the initial examination since 1916, and who had not previously engaged in mining. The question may naturally be asked, Why are the old miners, and the old miners almost exclusively, now developing silicosis, if the dust menace underground has practically disappeared? There are two reasons for this: the first is that dust particles have accumulated in their lungs over a longer period, and the second and far more vital reason is that these men have been exposed to tuberculosis infection, and it is this infection which has brought about the development of what would otherwise have been a latent silicosis. It appears that this tuberculosis infection is usually insufficient in amount to give rise to obvious tuberculosis.

"It is gratifying to record that 1925 has been another successful year for the Rand refinery, the operations of which have been uninterrupted. For the year the gross weight of the bullion received amounted to 10,907,994 oz., an increase of 194,655 over the 1924 receipts. Direct shipments of refined gold to the East continued on a considerably increased scale, chiefly to Indian purchasers. Owing to the disappearance of the premium, gold was realized at the standard rate. Sales to the Reserve Bank amounted to 5,592,267 standard ounces, and consignments totaling 235,569 standard ounces were sent to Australia. The amount of fine silver purchased by the Indian market was 928,250 oz.

"From a review of the past one turns naturally to speculation as to the future. We all hope, in the interests of the country as well as in our own interests, that the mining industry of the Transvaal has a long and prosperous career before it. Whether these hopes will be fulfilled depends largely upon the treatment which the industry receives in future from the government and the country, more particularly now that the return to a gold basis has put an end to the gold premium. If we are treated with the sympathy that the industry, which is the mainstay of the Union's prosperity, has the right to expect, I have little doubt that the inevitable termination of the life of the older mines will be compensated for to a considerable extent by further developments. If, on the other hand, we are to be continually harassed by outside interference and regarded merely as a bottomless purse from which the wants of every other section of the population can always be supplied, the premature extinction of the industry is inevitable. To open up a new mine, is, always and everywhere, a hazardous speculation: and, in the present circumstances of the Rand, it demands an enormous capital outlay—for instance, the Government Mining Engineer calculated that an expenditure of nearly two million pounds would be required to bring to the producing stage the property recently offered by the government on lease. Money on this scale can only be obtained from overseas; and it will certainly not be obtainable from anywhere unless its controllers are satisfied that they will receive a square deal in this country. It is undeniable that there has been little manifestation of such sympathy in recent years. Directly and indirectly the mines contribute far more than their share of the revenue of the Union, largely because they are charged excessive amounts for services rendered. It is difficult to calculate with any accuracy the profit made by the Railway Administration upon such items as hauling coal to the mines; but it may be asserted with confidence that the charges exceed the cost by an enormous amount—and this surplus is expended in ways which are of no benefit whatever to our industry, or even detrimental thereto by raising the cost of administration of the country and the cost of living."

Recent Technical Publications

Reviews, Abstracts, and References

Dr. Niggli Discusses Ore Magmas

Versuch einer natürlichen Klassification der im weiteren Sinne magmatischen Erzlagerstätten.

(Attempt at a Natural Classification of the Broadly Magmatic Ore Deposits.) By Paul Niggli. Pp. 69. Wilhelm Knappe, Halle, Germany. Paper covers. 4.80 gold marks.

A review by J. E. Spurr

Dr. Paul Niggli is a distinguished physical chemist and geologist, whose recent work on "The Volatile Constituents of the Magma" has been recognized as a classic. Therefore his shorter work, now reviewed, is of great interest to students of ores. On account of the complexity of problems, and the short space allowed, no critical discussion will be here undertaken; but a few high points in the presentation of the problems by Dr. Niggli will be mentioned.

"Those ore deposits which are connected with the formation of igneous rocks are, with the exception of very few types, consequences of the content of volatile constituents in the magma," the paper begins. "Whoever is content with following magmatic activity only so far as the formation of igneous rocks, voluntarily cuts off an actual and important part from a group of phenomena which belong together."

The plutonic magmatic formation of mineral aggregates, the writer observes (p. 6), falls into two chief stages, those of the igneous rocks and of the ore deposits; the transition between these must in depth be a gradual one. "The solutions from which the pegmatites are formed show all transitions from normal igneous rock to ore deposit. J. E. Spurr has especially called attention to this relation." He divides magma consolidations in depth (about 2 km.) into three chief stages: 1, a liquid magma stage, which includes the formation of the igneous rock proper; 2, a pegmatitic - pneumatolytic stage, which is transitional between the molten silicate solutions and the residual solutions; 3, a hydrothermal stage. Each of these successive stages is quantitatively less than the preceding one, but all are magmatic formations; and the study of all, including that of the residual solutions, belongs in the field of magmatic differentiation (p. 8). In the residual solutions the tension is a measure of the intrusive power; the viscosity, of the power of penetration. "The pegmatitic - pneumatolytic solutions will penetrate wherever they find localities of weak pressure; they show in a high degree the peculiar activity of magmas." The intrusive power of the hydrothermal residues is weaker.

The separation of a gas phase in depth is not considered: this can only originate when and where the vapor tension of the residual solutions is greater than the external pressure. The pneumatolytic solutions in depth are above the critical point: they are neither liquid nor gaseous, but *fluid;* in this condition the separation of a gas is impossible. These conditions govern at the depths above stated, in the hypabyssal region; at still greater depths the lower temperatures of the hydrothermal solutions are never reached; the last residues are the pegmatitic - pneumatolytic ores (p. 10). "Only at the middle depths of the earth shall we discover a normal and approximately complete succession of the formations resulting from the magmatic residues; at greater depths the last stages are lacking and everything is compressed to the pegmatitic-pneumatolytic phase; at shallower depths the earliest stages are lacking and there is a compression of occurrences into the hydrothermal group." (P. 13.)

Ore Magmas

"Between liquid-magmatic and pegmatitic-magmatic mineral formation on the one hand, and mineral formation by volcanic exhalations, on the other, there must be, in accordance with pressure and temperature, a field of magmatic mineral formation which stands in the closest relation to the two extremes. The investigation of ore deposits is again and again drawn to the comparison of pegmatite consolidation and fumarole formation. If there are differences between the newest proposals of J. E. Spurr and the views expressed by J. H. L. Vogt, W. Lindgren, and W. H. Emmons, they are only qualitative. Spurr believes that many deposits have features of close similarity with liquid magmatic consolidations. The other authors hold that the relationship is closer with fumarolic deposition and precipitation from recent hot springs. We must investigate this difference of opinion through the special consideration of ore deposits. The practical unanimity, however, gives us the assurance that the assumption that magmatic ore solutions are the normal residual solutions of a comprehensive magmatic consolidation, is essentially correct. In this sense Spurr's term 'ore magmas' is to be agreed to without reservation; is indeed to be gladly welcomed, in that ore formation is presented as a phenomenon of magmatic differentiation." (P. 14.)

Dr. Niggli gives a generalized table of the order of separation of the various ores (p. 16), beginning with native platinum and ending with cinnabar. The "liquid-magmatic" group of deposits is subdivided into two parts: eruptive rocks and liquid-magmatic ore deposits. The pegmatitic-pneumatolytic group is subdivided into four: pegmatite, pneumatolytic deposits of the heavy metals, pneumatolytic tin-tungsten deposits, and pyritic tourmaline-quartz deposits. The hydrothermal group is also divided into four: hydrothermal pyrite-gold deposits, lead-zinc-silver deposits, nickel-cobalt-silver deposits, and siderite and plutonic antimony-mercury deposits (p. 17). Veins of siderite, barite, and fluorite (and calcite) often form the close of magmatic activity.

Considering the mineralogical-chemical types of ore deposits of magmatic origin, Niggli observes that they may be classified from various viewpoints (p. 25): 1, according to physical-geological relations of the place of formation; 2, according to the chemistry or/ and mineral composition; or 3, according to the relationship to certain petrographic provinces. All of these must be considered.

In the first category (1) are, primarily, pressure and temperature at the time of formation. The useful division of igneous rocks into plutonic, intrusive, and extrusive is a division according to physical factors, seen in geological combination. "The speed with which cooling takes place, the variety of shape of the resulting formation, the possibilities for separation out of the volatile constituents as a result of altered gravity pressure are the causes of the generally different character of intrusive and extrusive igneous rocks. When it comes to mineral formations (deposits), to which the volatile constituents are apportioned in an important degree, these different factors are still more effective." (P. 25.) Therefore the classification into intrusive (plutonic) and extrusive (volcanic) may be applied to all magmatic formations (deposits). "For ore deposits this is indeed a necessity."

"Volcanic" Ore Deposits

Concerning the "young" or volcanic gold-silver ore deposits, they differ from the plutonic gold-silver ore deposits in three points, which are explained through the difference in the localization of the place of formation. "1, In the former the connection with the pegmatitic-pneumatolytic formations, which is typical for so many gold-quartz veins, is lacking; 2, we find in the former a combination of elements (gold, silver), which in general are separated in the intrusive (plutonic) deposits, where through slower formation and cooling of the solutions the stages of precipitation are separated one from another; 3, the manifold processes have overlapped one another[1]. Frequently we find earlier-formed minerals dissolved or replaced metasomatically by others. Therefore, it seems to me, as Spurr has specially pointed out, not quite correct to assign a very low temperature to the whole formation. The different crystallizations have surely spread over a wide range of temperature." (P. 26.)

"Contact Deposit" Unfortunate

Dr. Niggli compares with his initial classification (a, liquid-magmatic; b, pneumatolytic; c, exhalative to hydrothermal), recent schemes of classification given out by Lindgren, Emmons, Beck-Berg and Beyschlag, Krusch, and Vogt. Concerning the group of "contact deposits" or "contact metamorphic ore deposits," Dr. Niggli observes, "If one does not at the start separate deposits in vein (veindike) form from replacement deposits, it is illogical to recognize as a group the so-called pyrometasomatic deposits[2]. In the classification in the 'Textbook of Mineralogy' (1920) I have therefore combined the

[1] "Telescoped." J. E. S.
[2] Of W. Lindgren.

pneumatolytic metasomatic deposits ('contact deposits') with the pegmatitic-pneumatolytic veins. Recently, J. E. Spurr has also pointed out how unfortunate is the old group designation 'contact deposit.'" (P. 29.)

Dr. Niggli criticizes mildly Lindgren's latest systematic classification[2]:

"The designation 'Emanation Deposits' does not seem to me quite happy, since according to the explanation in the physical-chemical part of this paper, it is difficult to differentiate between deposits which are really formed from magmatic vapors and those which originate from magmatic residual solutions. I believe that a great part of the pyrometasomatic deposits originates from fluid solutions. The designations epi-, meso-, hypothermal bring temperature into a simple connection with terrestrial depth, as in Grubenmann's classification of the metamorphic rocks. It is nevertheless questionable whether all the types of deposits assigned to the epithermal group really have a lower temperature of formation than do the mesothermal types." (P. 29.)

Considering (2) mineral deposits according to the chemistry or/and mineral formation, Dr. Niggli presents Lindgren's 1919 classification and that of Beck-Berg (1922), observing "The chemical-mineralogical main groups are doubtless to a certain extent lacking, in the newer textbooks of ore deposits. Especially, when one writes down these headings, logical *non sequiturs* strike one, which are greater in Lindgren's classification than in the very clever comprehensive grouping of Beck and Berg." (P. 31.) Dr. Niggli suggests, as chemical-mineralogical composite types of the earlier-explained physical-geological divisions: for the plutonic-liquid magmatic group, three: 1, the diamond-platinum-chrome deposits, rich in magnesium silicate; 2, the titanium-iron-nickel (copper) deposits, associated with basic magma; 3, the igneous rocks which are supersaturated with alumina.

The physical-geological division of pegmatitic-pneumatolytic ore deposits is separated into two groups; 1, the pneumatolytic silica - alkali - fluorine-boron-tin-molybdenum tungsten (bismuth) deposits, including most of the pegmatites, and a part of the pyrometasomatic contact metamorphic rocks; 2, the heavy metal-alkaline earth-phosphorus-titanium deposits.

The plutonic hydrothermal ore deposits are divided into: 1, the hydrothermal iron-copper sulphide and the hydrothermal gold-(arsenic)-(platinum) deposits; 2, the hydrothermal-lead-zinc-silver ores; 3, the nickel-cobalt-arsenic-bismuth-silver ores; and 4, the magmatic-hydrothermal carbonate-(oxide)-sulphate-fluorite deposits. (P. 33.) All the above are classifications of "plutonic" ores, with which are contrasted the superficial magmatic or "volcanic" ores.

The "volcanic" division of ore deposits Niggli divides into four groups according to chemical-mineralogical characteristics: 1, the small group of the volcanic commoner heavy metal deposits; 2, the volcanic gold-silver ores; 3, the volcanic silver-tin-bismuth ores; 4, the volcanic antimony and quicksilver ores; and 5, the zeolitic native copper ores. (P. 34.)

Considering ores from the standpoint of their associations with general earth structure, Dr. Niggli observes, "Since according to the conception just developed the magmatic ore deposits represent products of magmatic differentiation, they belong to the characterization of a magmatic province. The question as to the succession of magmatic differentiation takes in the problem of igneous rock (petrographic) provinces, and also that of magmatic ore (metallographic) provinces. We see at once that in both cases similar problems arise." (P. 41.)

Classification of the earth according to the age of the geologic-tectonic units also involves in a broad way a separation of the magmatic ore deposits: this has a cause which is generally overlooked. "That is, nearly every intensive magmatic ore formation was followed by a period of erosion—in other words the complete magmatic ore deposit formation is more or less connected with zones of rock folding." (P. 42.) A brief presentation of these relations (making use of the presentation of Lindgren and De Launay) results in a division into: *a*, the deposits in the Archaean rocks; *b*, the deposits in the Proterozoic and Paleozoic rocks; and *c*, the deposits in the Mesozoic and Cenozoic rocks. Space does not permit the reviewer to go further into the detail of the assignment of ore deposits and ore regions by Dr. Niggli under these headings.

Considering (p. 53) the known connection of certain ore deposits with special types of eruptive rocks, Dr. Niggli observes, "J. E. Spurr in his newest book gives these orders of succession which he characterizes by means of the most important elements or their minerals." (There follows the table from "The Ore Magmas," p. 611). Dr. Niggli concludes that all such classifications develop the fact that copper, lead, and zinc deposits have no close relation to the silica content of the magmas. (P. 57.)

Pacific and Atlantic Magmas

Referring to the classification of magmas into two broad groups or branches (suites), Pacific and Atlantic[4], of which the alkaline rocks represent the Atlantic suite, Dr. Niggli concludes that "the great majority of magmatic ore deposits are associated with igneous rock provinces of Pacific or Mediterranean character." (P. 57.) But, he inquires, do the various tendencies toward differentiation within the Pacific province produce different types of ore deposits? He considers two possibilities: 1. "That in order for solutions or vapors to originate, which are capable of forming commercial ore deposits, there is necessary a liquid magmatic differentiation to the ore magmas proper. The solutions and vapors are then residues and products of this special product of differentiation, which is rich in ore-mineral molecules. We might designate this hypothetical ore magma as a special type of lamprophyric magma, and assume the formation of this ore-lamprophyre fraction-magma as preceding the pneumatolytic-hydrothermal ore deposition." 2. It is *a priori* also possible that the ordinary silicate magma is capable of separating out vapors and residual solutions, which can form ore deposits. "The hydrothermal ore solutions would be in short the last residues of ordinary silicate magmas. Just as the granitic magma in general represents a residual magma, so in a more extreme form the ascending hot solutions would be the last derivatives of a normal magmatic process of consolidation." (P. 58.) He concludes that the question whether "certain 'molten' ore magmas may originate, in this way, in analogy with the formation of lamprophyric magma, must be answered in the affirmative." But in many cases it is evident that fluidity existed at temperatures possible only if considerable of the volatile constituents were in the solution: these ore magmas are partly liquid-magmatic, partly pneumatolytic-pegmatitic (p. 59). His final conclusion is that both methods of origin (listed above as 1 and 2) exist.

"Examples for both methods of origin may be found. A part of the so-called injected pyrite deposits contains abundant quartz gangue. These, as contrasted to the copper-nickel-pyrrhotite deposits, appear to be solution-melts already rich in water. In other words, the sulphide melts have taken up volatile matter. On the other hand, pyrite veins (veindikes) and gold-quartz veins (veindikes) are so often in close relation to pegmatitic formations, that a direct derivation of the solutions in question from ordinary magmatic residues is indubitable. It is advisable to consider the various possibilities of origin, and to weigh them against one another, in specific cases. Characteristic mineralogical differences between the two cases are hardly to be expected, since in a way the only question is whether the ore solution originated all at once or by fractions. . . . It is nevertheless quite thinkable, that certain materials can only be concentrated in the later ascending solutions or vapors if in one way or another a first enrichment is achieved by liquid-magmatic differentiation." (P. 60.)

Submarine Magmatic Deposits

Dr. Niggli treats most suggestively the formation of magmatic deposits beneath the oceans. "Submarine flows and sills are frequent phenomena. The volcanic-submarine and also the sedimentary type of ore deposits therefore is in notably close relation with such igneous rocks.

"An example of a great province rich in such basic igneous rocks is the Lake Superior region. The ore deposition in this region is typical of basic and predominantly volcanic magmas. The greatest iron deposits in the world are found here, in the pre-Cambrian complex. Doubtless original chemical sedimentation is the chief agency, but the sediments are in such close relationship with altered diabase that we must assume a powerful influence of volcanic exhalations, which in large part were the cause of the changed chemical

[2] *Economic Geology*, Vol. XVII, 1922, pp. 292-294.

[4] A conception first put forth by Harker Daly ("Igneous Rocks," 1914, p. 412, *et. seq.*) entirely rejects this division. J. E. S.

conditions in the then shallow seas. . . . This seems to be a typical case of a submarine-volcanic and at the same time chemical (presumably biochemical) ore deposit." (P. 61.) As to the Lake Superior copper deposits, "what interests us especially here is the combination of copper and basic lavas, which is a widespread phenomenon. Submarine-volcanic and at the same time chemically precipitated copper deposits are also known." (P. 62.)

"The basic, relatively little differentiated magmas are capable of forming a series of ore deposits, ranging from the plutonic liquid magmatic to weak pneumatolytic and hydrothermal. Here is also the home of the volcanic-subaquatic and at the same time chemical-sedimentary type of ore deposit. The controlling factor is always to be understood as geological. Siliceous submarine eruptions are very rare; basic eruptions are the normal phenomenon at the beginning of a major folding movement."

Dr. Niggli comes to the conclusion "that deposits of the tin group and of the rich gold-bearing groups can only occur if the elements in question were relatively concentrated in the fluid melt by a preceding liquid magmatic differentiation. That is also the sense of Spurr's classification. But some lead-zinc-silver deposits may be again formed in the course of such a differentiation, and copper deposits and iron ores are often accompaniments of the differentiation which leads to a granitic or a granodioritic magma. Only the platinum metals, chromium, and most of the nickel and cobalt, are in general separated out from the magma so early that they never recur in the later stages of the process of differentiation." (P. 64.)

"Apomagmatic" Deposits Defined

Ore deposits such as those of the Mississippi Valley and similar European deposits Dr. Niggli calls "apomagmatic." They are not closely associated with igneous rocks. But "the mineral composition reminds one throughout of that of the hydrothermal ore deposits which are closely allied to basic magmas. The most important ores are galena and blende. Associated with these are marcasite and pyrite, chalcopyrite, cobalt-nickel ores (as, for example, linnaeite in southeastern Missouri) as well as siderite and ankerite. . . . The siderite veins of Siegerland, which, to be sure, stand in no evident relation to the lead-zinc deposits of the lower Rhine, are transitional into copper and cobalt veins." (P. 66.) "Therefore I conclude that we have here 'telemagmatic' formations of a basic magma, which through the deep tectonics of a neighboring mountain uplift was enabled to slowly give off ore solutions. . . . For the industrially very important deposits of the Mississippi valley, J. E. Spurr has assumed a quite similar origin." (P. 67.)

Dr. Niggli's final word is that "The formation of magmatic ore deposits is a process which cannot be separated from the other processes of magmatic formation of mineral deposits. The problems of the study of metallology are parts of the problem of petrology."

Patents

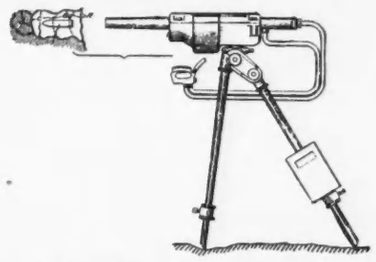
Rock-Drilling Equipment

No. 1,584,715. May 18, 1926. L. C. Bayles, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A spool valve for rock drills.

No. 1,585,428. May 18, 1926. F. M. Slater, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J.. A graduated air-feed relief for rock drills.

No. 1,585,428. May 18, 1926. F. M. Slater, Easton, Pa., assignor to Ingersoll-Rand. Design of a rock drill of the hammer type.

No. 1,585,664. May 25, 1926. G. H. Gilman, Boston, Mass. A method and apparatus for breaking out rock by shooting into a cavity in the rock successive charges of explosive, each sufficient to break out a limited quantity of the rock, and each exploding by impact.



The apparatus and its operation are indicated in the accompanying cut.

No. 1,585,668. May 25, 1926. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A drill-steel guide to keep a correct alignment between the steel and the rock drill.

No. 1,585,821. May 25, 1926. L. C. Bayles, Easton, Pa., assigned as above. A relief valve device for the feed cylinder of a rock drill.

No. 1,585,822. May 25, 1926. L. C. Bayles, Easton, Pa., assigned as above. Design for a rock drill.

No. 1,586,243. May 25, 1926. Joseph Henritzi, Spokane, Wash. Application of idler pinions to rotary rock drills having cone bits.

No. 1,586,415. May 25, 1926. Oswald Duda, Houston, Tex., assignor to Reed Roller Bit Co., Houston. Design for a rotary core drill.

Nos. 1,588,406-7-8. June 15, 1926. G. H. Gilman, Boston, Mass. Three designs for a hammer piston drill.

No. 1,588,441. June 15, 1926. H. L. Browne, Houghton, Mich., assignor to G. H. Gilman, Boston. Design for a hammer drill.

No. 1,589,255. June 15, 1926. W. A. Smith, Athens, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design of a valve chest for a hammer drill.

Fume Precipitation—No. 1,588,072. June 8, 1926. C. H. Weiskopf, Hawthorne, Calif., assignor to International Precipitation Co., Los Angeles. Method of mounting and jarring electrodes used in fume precipitation by the Cottrell process.

Reducing Furnace — No. 1,588,217. June 8, 1926. William Winkelman, Los Angeles. A furnace for reducing finely divided ore by bringing it in contact with carbon monoxide while passing through transverse passages, and without sintering.

Conveyor — No. 1,584,793. May 18, 1926. G. L. Morehead and F. S. O'Neil, Indianapolis, assignors to Link-Belt Co., Chicago. A process of manufacturing steel conveyor chains.

Malleable Nickel—No. 1,584,959. May 18, 1926. C. P. Madsen, Newark, N. J., assignor to Madsenell Corporation, New York City. Electrodeposited nickel of a dense reguline structure, malleable and ductile, and substantially free from pores, pits, and hydrogen.

Electric Furnace—No. 1,585,344. May 18, 1926. W. E. Greenawalt, Denver, Colo. A vertical shaft furnace with electrodes for heating the charge and means for injecting a reacting fluid into the body of the charge.

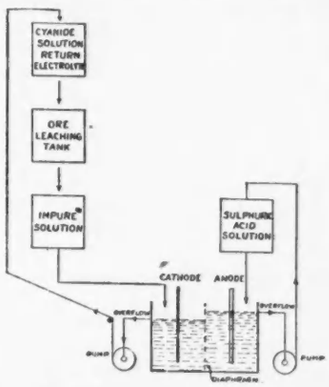
Crushers — No. 1,585,457. May 18, 1926. C. B. Andrews, High Bridge, N. J., assignor to Taylor-Wharton Iron & Steel Co., High Bridge, N. J. An outer disk assembly for grinding mills of the disk type.

No. 1,587,085. June 1, 1926. C. B. Rogers, Joplin, Mo. Design for a jaw crusher.

Removal of Colloids—No. 1,585,755. May 25, 1926. W. O. Borcherdt, Austinville, Va., assignor to the New Jersey Zinc Co., New York City. Colloidal constituents interfering with the nodulizing of a mineral pulp are removed by a suitable grinding and classification treatment. Patent No. 1,585,756 covers the removal of deleterious colloids by differential flotation treatment.

Hafnium-Zirconium — No. 1,586,241. May 25, 1926. Dirk Coster, Haarlem, Netherlands, and Georg von Hevesy, Copenhagen, Denmark, assignors to N. V. Philips' Gloeilampenfabrieken, Eindhoven. A method for separating the elements hafnium and zirconium.

Electrolytic Process — No. 1,587,438. June 1, 1926. U. C. Tainton, Johannesburg, Transvaal, South Africa. Insoluble anodes are inclosed with a porous partition, a solution being fed into the compartment thus formed, of a nature that will not attack the anodes. A diagram accompanying the patent is shown in the accompanying illustration.

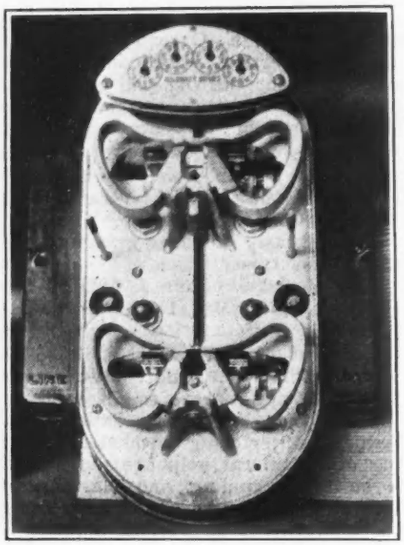


Sulphur Dioxide Recovery—No. 1,589,133. June 15, 1926. A. H. Eustis, Milton, Mass. Sulphur dioxide gas in smelter smoke or other gases is absorbed in a liquid in the presence of a metallic compound adapted to the formation of an unstable sulphite that is soluble in the liquid and is not susceptible to oxidation to an insoluble sulphate. The resulting solution is then decomposed by exhaust steam.

New Machinery and Inventions

Lamp on Watthour Meter Shows Circuit Is Open

In order to show that the potential coils of the instrument are energized, an indicating device has been introduced by the General Electric Co. on its



Lamps show condition of meter

type D-7 polyphase watthour meter. On the ordinary meter of this kind an interruption in the potential circuit is not always easy to detect; a blown fuse may go unnoticed for some time, and in the meanwhile the instrument registers only a portion of the power it is supposed to measure.

In the new instrument a few turns have been taken around the outside of the potential coil of each element. These serve as a transformer to energize a small, low-voltage lamp on the front of the meter, one such lamp being employed for each element. If one of these lamps fails to burn it signifies an open potential circuit which by this means may be promptly detected by the meter reader or operator and corrected with little loss of time.

Welder and Air Compressor Combined in One Unit

A combination air compressor and arc welder driven by a gas engine and mounted on a single base has been placed on the market by Schramm, Inc., of West Chester, Pa. The outfit consists of a Buda gasoline engine, a Schramm compressor, and a General Electric welding device. The complete equipment may be mounted on a standard two-ton truck or can be made portable by adding wheels.

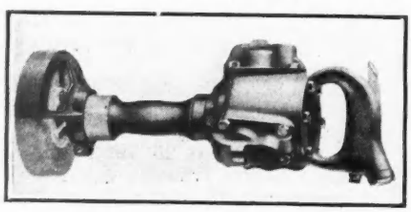
The Buda engine is a 24-hp., 800-r.p.m. unit, which may be started and operated independently of either the compressor or welding generator. The Schramm compressor is a two-cylinder, water-cooled machine with a capacity of 120 cu.ft. per minute and equipped with an automatic unloading device. The air receiver is 16 in. in diameter by 42 in. high. The General Electric welding equipment consists of a belt-driven WD-12 arc welder with an idler pulley for belt tightening. By the use of a Borg & Beck 12-in. clutch coupling, either of the machines may be connected to the engine.

This combination outfit is expected to be of great value in field work. The air compressor can be used to operate drills, grinders, and chipping hammers for cutting, peening, caulking, and cleaning off scale. The compressor can also be used in preparing work for welding. With the G-E WD 12 welder, light and heavy gage steel can be welded as well as cast iron. After the welding is completed, the compressor clutch is thrown and the weld can be ground or chipped as desired. Thus a complete job can be done with the single machine.

The structural steel base is 8 ft. 4 in. long and 5 ft. 11 in. wide. The outfit is 3 ft. 10 in. high, and weighs 4,000 lb.

Two New Small Tools

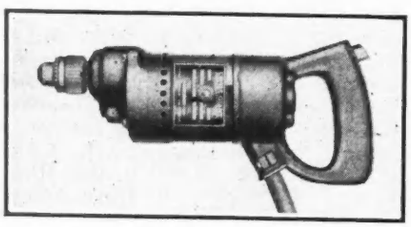
A portable pneumatic grinder and a ¼-in. electric drill are two new products of the Chicago Pneumatic Tool Co., New York City. The grinder is for use on many classes of work where high speed and continuous service is a necessity. It has three cylinders 120 deg. apart, each cylinder provided with its own valve of the piston type. It is designed with especial attention to accessibility for repair. It has a speed of 4,000 r.p.m. and weighs 15½ lb. The



Portable pneumatic grinder for continuous service

wheel or wire brush is 6 in. in diam. by 1 in. wide.

The new ¼-in. electric drill is of the pistol grip type. It is not necessary to hold in the switch. Speeds on d.c. and a.c. are practically the same, and all gears are made of chrome-

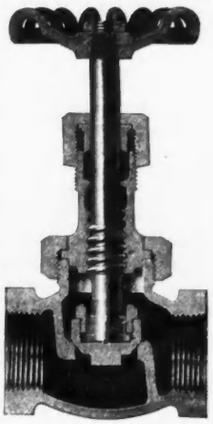


The parts of this electric drill and readily accessible

nickel steel. It also is designed for accessibility, and the entire switch assembly can be removed for inspection and repairs. The net weight is 6½ lb., and the overall length is 12¾ in. At full load the approximate speed is 1,280 revolutions per minute.

Two-Piece Bonnet on New Line of Valves

A new line of brass valves has been developed by the Ohio Injector Co., Wadsworth, Ohio, which features a two-piece bonnet. Such a bonnet has the advantage of permitting the joint between the body and the bonnet to be made in such a manner that the thread is outside of the seat and thus protected from the action of the fluid passing through the valve. This bonnet construction also greatly facilitates the grinding-in of the valve without removal from the line. A full pipe area at all points and full length pipe threads are claimed for these valves. Flanged-end valves are for steam working pressures up to 150 lb. Screwed-end valves from ⅜ to 1¼ in., inclusive, for steam-working pressures up to 225 lb. and from 1½ to 3 in., inclusive, for pressures up to 200 lb.



Trade Catalogs

Centrifugal Pumps — Bulletin 406 covers the horizontal split-case multi-stage centrifugal pumps made by the Economy Pumping Machinery Co., 122 No. Curtis St., Chicago, Ill.

Pulverized Fuel—Catalog U-2 of the Combustion Engineering Corporation, 43 Broad St., New York, describes the C-E unit system for burning pulverized fuel. This catalog replaces edition U-1. The system combines a pulverizing mill of the impact type with a furnace properly designed for burning pulverized fuel. It is applicable to boiler units of all sizes from 150 hp. up.

Compressors — Sullivan Machinery Co., Chicago, Ill., has issued bulletin 83-D covering its line of portable air compressors, WK-314, WK-32, and WK-34. These constitute three distinct types. The first two are gas-engine-driven, the third is belt-driven from an electric motor, and the fourth belt-driven from a tractor.

Fans—American Blower Co., Detroit, Mich., has issued Bulletin 703, covering American HS fans. These are high-speed fans of the centrifugal type.

Cranes, Hoists—Catalog 100 of the Milwaukee Electric Crane & Manufacturing Corporation, Milwaukee, Wis., describes the company's line of electric traveling cranes and hoists.

Dryers — The Ruggles-Coles Engineering Division of the Hardinge Company, York, Pa., has issued Catalog 16A, containing 32 pages, covering Ruggles-Coles dryers.

Air-Lift Pumping—The Sullivan Machinery Co., Chicago, Ill., has issued Bulletin No. 71-I, 48 pages, on air-lift pumping methods and equipment. Typical air-lift pumping installations in municipal, railway, and industrial service are described in the book.

The Market Report

Metal Markets Quieter, Though Tin Prices Set New Post-war High

New York, Aug. 11, 1926—The volume of copper sales took a marked drop in the week ending today, and there was also less inquiry for lead. Prices were well maintained for both of these metals by most sellers, however. Zinc was somewhat more active, though at somewhat lower prices. Tin touched the highest price in seven years, but silver has been very weak.

Copper Wobbles at 14½c.

The large producers have been almost uniformly at the 14½c. level for Eastern deliveries all week, and at 14⅝c. in the Middle West, but have sold practically nothing except to regular customers who are not inclined to haggle about prices. The market has been so quiet that several sellers, mainly the smaller ones, have had to shade these prices, and even then the total tonnage sold was less than half of that of last week. Some consumers near the refineries have been able to obtain copper for as low as 14.35c., delivered, whereas several sales at Connecticut points have been made between 14.375 and 14.45c. Today, the large producers seem united in quoting the market at 14½c., but three or four other sellers have again been willing to shade prices and have booked orders all the way from 14⅜ to 14½c.

Most of the copper sold has been for September or October delivery, though an occasional demand for August appears. Sellers make no distinction in price. Inasmuch as the volume of sales in July was the greatest in at least a year, no great concern is felt at the present quiet market; in fact, many producers rather welcome it, as they are practically sold out of August and September copper and do not wish to refuse their regular customers.

The export market has been exceedingly quiet so far as American agencies are concerned; they have been quoting 14.65c., c.i.f., in general, whereas dealers have sold at concessions.

Zinc Stocks Decline Again

Zinc has been somewhat weaker, one sale having been reported as low as 7.275c., St. Louis, last Friday, though on the same day a carload of October metal was sold at 7.45. Since the statistics were issued, prices have firmed up slightly, the stocks having undergone another substantial decline. The only unfavorable figure was the increase in the number of retorts operating at the end of July, about 7,000 more being in commission then compared with June 30. The data as issued by the American Zinc Institute follow, the figures being in tons of 2,000 lb.:

Stock, July 1	25,760
Produced	48,403
Shipped	51,177
Stock, July 31	22,986
Shipped from plant for export	4,587
Stored for customers	977
Retorts operating July 31	83,980

The volume of sales during the week has been good, galvanizers showing more interest in the market, probably tempted by the price concessions. Most of the buying has been for August or September shipment. High-grade has commanded 8¾c. delivered in the East, on actual sales; the 9c. quotation is hardly more than nominal.

Little Change in Lead

No change has been made during the week in the current price of lead set by the American Smelting & Refining Co., formerly established at 8.90c., New York, and the principal sellers in the Middle West have also been quoting

Daily Prices of Metals

Aug.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
5	14 20	64 50	65 25	8 90	8.775	7.35@7.40
6	14 225	64 625	65 625	8 90@8.925	8.775	7 325
7	14 225	64 625	65.625	8 90@8.925	8.775	7 30
9	14 20	64 875	66.125	8 925	8.775	7 30
10	14.20	64 75	65 875	8 925	8 775	7 30
11	14 175	64 125	65 375	8.925	8.775	7.325@7.35
Av.	14 204	64 583	65 646	8 917	8 775	7 323

The prices correspond to the following quotations for copper delivered: Aug. 5th, 14.45c.; 6th and 7th, 14.475c.; 9th and 10th, 14.45c.; 11th, 14.425c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
5	59	59 7/8	67	295 1/4	288	33	32 9/16	34 1/4	34 3/4
6	58 5/8	59 3/8	66 3/4	296 1/4	288 3/4	32 9/16	32 1/4	34	34 1/2
9	58 3/4	59 1/2	67	298 1/2	290 1/2	32 3/4	32 3/8	33 15/16	34 1/2
10	59	59 3/4	67	297 3/4	290 1/2	33	32 11/16	34 5/16	34 5/8
11	58 3/4	59 1/2	67	294	287 1/4	32 13/16	32 1/2	34 5/16	34 5/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
5	4 85 5/8	62 3/4	29 1/16	84s10d	9	4 85 5/8	62 1/2	28 13/16	84s10 1/4d
6	4.85 5/8	61 5/8	28 5/8	84s10 1/2d	10	4.85 5/8	62 1/8	28 5/8	84s10 1/4d
7	4.85 11/16	61 7/8	28 1/2		11	4 85 3/8	62 1/4	28 11/16	84s10 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

substantially unchanged prices. Some lead has been sold in the East at slight premiums, mostly 8.95c., though on chemical lead shipped from the Middle West as high as 9.10c. has been realized in Connecticut. Producers' prices on a St. Louis basis have been from 8.75 to 8.85c. in most instances, with dealers trying to get 8.95 or 9c. Both the volume of inquiries and the number of sales have been less than last week, though the situation continues firm, and no important change in price seems in prospect.

Tin Touches 66½c.

Spot Straits tin sold as high as 66½c. on Monday, when business was active, but has since reacted, so that today prompt deliveries can be obtained at but little above 65c. The high price established a peak for the post-war market. Some good orders have been placed for forward delivery, October delivery being about 1@1¼c. below the prices asked for prompt.

Francs About 2¾c.

Closing cable quotations on the important European exchanges on Tuesday, Aug. 10, were as follows: francs, 2.7625c.; lire, 3.345c.; and marks, 23.81c. Canadian dollars, $\frac{5}{32}$ per cent premium.

Silver Drops to 61⅝c.

The publication last week of the report by the Royal Commission on Indian Currency and Exchange caused a flood of selling orders in the markets of the world, which was naturally reflected by a sharp break in the price of silver. On the decline London rates dropped to 28½d. on Aug. 7, which quotation has not been touched since March 23, 1916. The recession culminated one day earlier in New York, when a price of 61⅝c. was quoted, thereby establishing a new low for five years, Aug. 23, 1921 being the last date on which this quotation was in effect. As is often the case, the selling was overdone and a natural reaction occurred due to short covering. China was a particularly heavy buyer and gave strong support to the local market on Aug. 9, thereby forcing prices well above what London and India were prepared to pay. Another decline followed, but even at the lower level the Indian bazaars are not prepared to enter the market. After these violent fluctuations silver seems to have settled at a lower level, and the market is quiet to dull with no definite tendency apparent at the moment. Additional information regarding the Royal Commission's report or further developments pertaining to its enactment into law may shortly give some indication of the future course of silver. Last week's statement that the Royal Commission had proposed that the rupee should be legal tender up to the amount of 50 rupees was incorrect. No change is suggested in the legal-tender character of the silver rupee; the proposal is that new paper currency should cease to be convertible by law into silver coin.

Mexican Dollars (old Mexican pesos): Aug. 5th, 47⅞c.; 6th, 47c.; 7th, 47¼c.; 9th, 47⅝c.; 10th, 47⅜c.; 11th, 47½c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—99 per cent grade, 27@28c. per lb.; 98@99 per cent, 27c. London, 98 per cent, £118 per long ton.

Antimony—Per lb., duty paid, New York: Chinese brands, spot, 16@16¾c. Forward deliveries about ¼c. less for each month ahead. Cookson's "C" grade, spot, 18½@18¾c.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, 1s. 10½d. for American metal; 1s. 9d. for Australian metal.

Iridium—Per oz., $125@$135 for 98@99 per cent. Nominal. London, £63@£65 in iridio-platinum.

Nickel—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Palladium—Per oz., $69@$71. Pure metal as a constituent of crude platinum, $60@$65 per oz. London, £12@£15, nominal.

Platinum—Official price on refined metal continues at $116 per oz. Open market cash sales of large lots at $112@$114. Pure metal as a constituent of crude platinum, $109.

London, £23½ per oz. for refined and £21@£22 for crude.

Quicksilver—Per 75-lb. flask, $89. Retail lots of spot metal about $2 higher. San Francisco wires $89.33; steady. London £15⅝.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the issue of Aug. 7.

Metallic Ores

Chrome, Iron, Manganese, Molybdenum, Tantalum, Tungsten, Uranium, and Vanadium Ores are unchanged from quotations in the Aug. 7 issue.

Zinc Blende and Lead Ore Prices Unchanged

Joplin, Mo., Aug. 7, 1926

Zinc Blende	Ton
High	$54.15
Premium blende, basis 60 per cent zinc	$51.00@ 52.00
Prime Western, basis 60 per cent zinc	50.00
Fines and slimes, 60 per cent zinc	49.00@ 46.00
Average settling price, all zinc	48.42
Galena	
High	114.35
Basis 80 per cent lead	112.50
Average settling price, all lead	111.61

Shipments for the week: Blende, 17,230; lead, 2,663 tons. Value, all ores the week, $1,131,600.

Some sellers withdrew zinc ore from the market today, but buyers had completed purchases of nearly all of the tonnage output of the week earlier. Purchases totaled 16,950 and production 17,430 tons; shipments were 17,230 tons. Only 160 mills are in operation, but a number are milling double shift.

Platteville, Wis., Aug. 7, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$52.75
Lead Ore	
Lead, basis 80 per cent lead	$112.50

Shipments for the week: Blende, 1,114 tons; lead, 40 tons. Shipments for the year: Blende, 32,581; lead, 792 tons. Shipments for the week to separating plants, 1,920 tons blande.

Non-Metallic Minerals

Magnesite—Imported ore, $40 per net ton, f.o.b. Eastern seaboard.

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Aug. 7 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3½c. per lb. Fair buying by glass makers and a little more interest by the insecticide industry. London, £13 per long ton.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Aug. 7 issue.

Ferro-Alloys

Ferrotungsten—Per lb. contained W, f.o.b. works according to grade, $1@$1.05.

Ferrocerium, Ferrochrome, Ferromanganese, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferro-uranium, Ferrovanadium, and **Spiegeleisen** are unchanged from prices in the Aug. 7 issue.

Metal Products

Rolled Copper—Per lb., sheets, 23c.; wire, base price, 16¼c.

Lead Sheets, Nickel Silver, Yellow Metal, and **Zinc Sheets** are unchanged from the prices quoted in the Aug. 7 issue.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and **Zirkite** are unchanged from prices in the Aug. 7 issue. The market has been slow but shows signs of improving.

Steel Steady

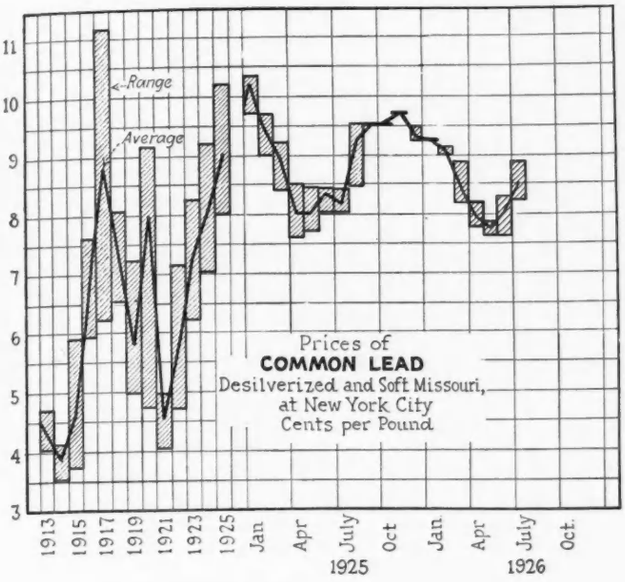
Pittsburgh, Aug. 10, 1926

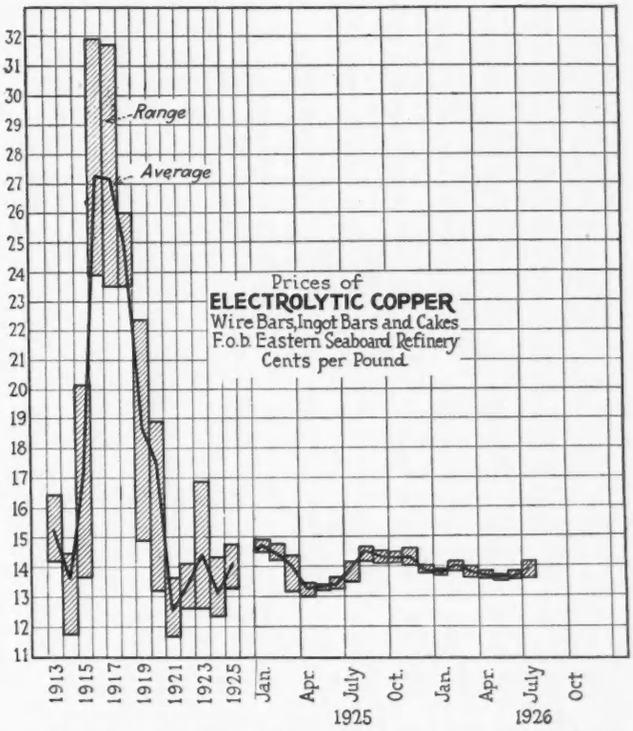
Steel prices continue very steady, having shown no quotable change in the last six weeks. There is strenuous competition for orders, but price cutting is not resorted to.

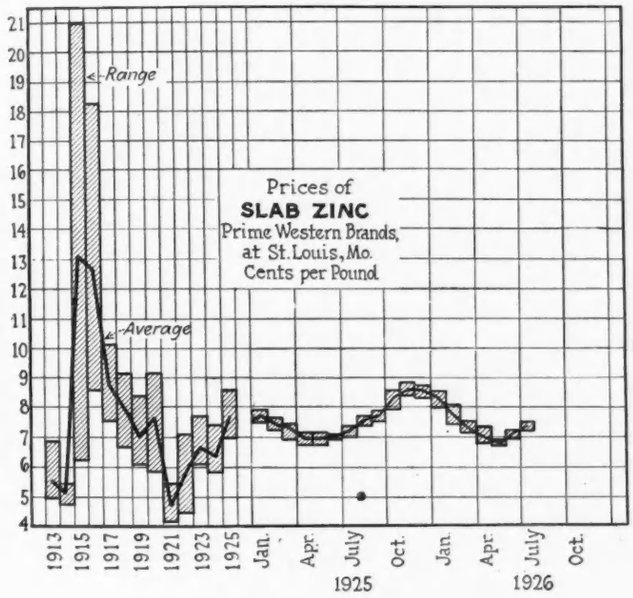
Pig Iron.—The Valley market is quiet, with prices not well defined, approximately $18.50 for bessemer, $17.50 for basic, and $17.50 for foundry.

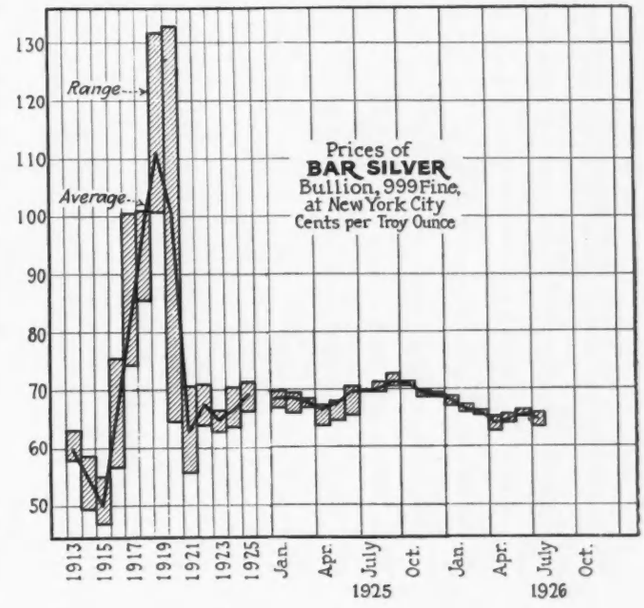
Connellsville Coke.—The market remains dull, with spot at $2.85@$3 for furnace and $4@$4.50 for foundry.

Metal Price Curves

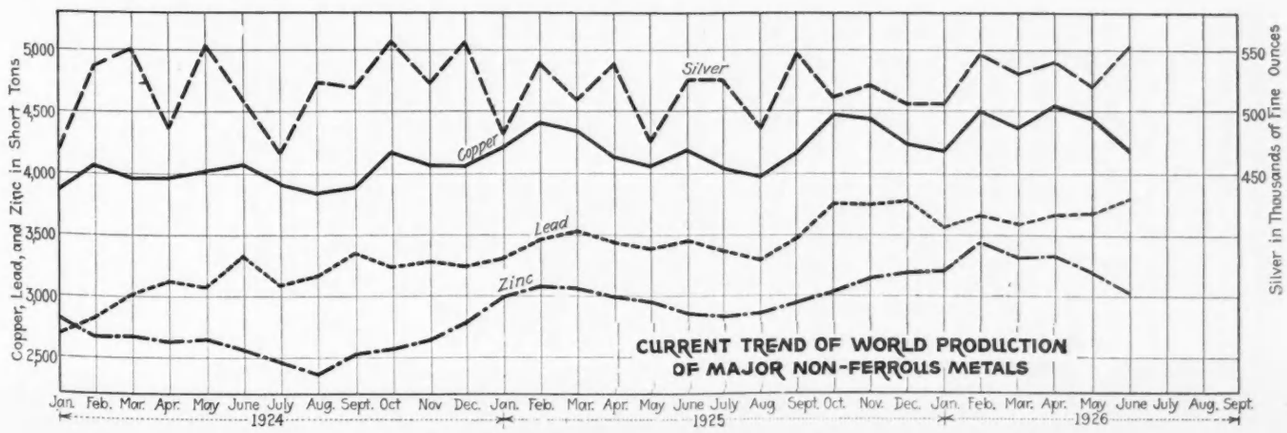



Range
Average
Prices of
ELECTROLYTIC COPPER
Wire Bars, Ingot Bars and Cakes
F.o.b. Eastern Seaboard Refinery
Cents per Pound
1913 1915 1917 1919 1921 1923 1925 Jan. Apr. July Oct. Jan. Apr. July Oct
1925 1926





THE curves below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output, according to latest estimates of the American Bureau of Metal Statistics. The figures represent countries that produced in 1924 and 1925 about 97 per cent of the world's output of copper; 78 per cent of the lead; 87.5 per cent of the zinc; and 81 per cent of the silver.


Silver
Copper
Lead
Zinc
Copper, Lead, and Zinc in Short Tons
Silver in Thousands of Fine Ounces
CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct Nov Dec. Jan. Feb. Mar. Apr. May June July Aug Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept.
1924 1925 1926

Review of Current Statistics

By Edward Hodges Robie
Assistant Editor

ANOTHER HEALTHY INCREASE in non-ferrous metal prices took place in July, as is shown by the heavy black bars in the graph on the opposite page, and the trend that existed the same time last year seems to be well duplicated. Though the June, 1926, index number was slightly below that for June, 1925, the July figure is somewhat above that of a year ago; in other words prices have recently been advancing faster than they did last year. It will be observed, however, that a very sudden jump was taken by the index in August, 1925, and as no marked increase in the price of any metal was observed in the first week of August just passed, it is likely that the curve may be a little more even this year. Whether or not the high point of 1925 will again be reached in the current year is, of course, in the laps of the gods, but it is generally thought that no industrial depression is likely to occur during the fall or early winter and that the year as a whole may be even better than was 1925. At any rate, the action of the stock market recently has indicated that the optimists are preponderant.

Silver is the only metal that did not hold its own or register an increase in price last month, and it has suffered a further sharp decline early in August. This seems attributable entirely to conditions in India, but it is not an unfavorable monsoon this time that is interfering with Indian demand, but rather a possible revision in the monetary system of that country whereby silver would lose some of its prestige in favor of gold. Some of the government stocks of silver may be sold. As a result of this agitation, India has not been buying silver to any extent recently, and the principal prop to the market has thus been removed, at least temporarily. It is not generally realized what a sinkhole for silver India is; that country's net imports last year were 107,000,000 oz., or about 45 per cent of the total silver production of the world.

Copper, lead, and zinc each rose in July from one-third to one-half cent over the June average, and the first two of these have continued their advance into August. Tin advanced 2½c., with the fundamental conditions in this industry so strong that the peak of prices in the post-war period has been reached. Nickel and aluminum, virtual monopolies, sold at unchanged prices, with an excellent demand reported.

No change of importance occurred in the non-metallic mineral price index, magnesite being the only one included in the index to show any variation, advancing slightly in California, following the decline a month ago. Demand for most of the non-metallic minerals is excellent, much of the quietness reported being of a seasonal nature. The index shown in the graph on the next page has now had five successive months of good, and practically unchanged, prices.

Stock Market Advances

The action of the stock market during July was generally favorable to holders of mining shares, the June advance continuing right into hot weather, especially for the copper companies and those that do a general mining, smelting, and manufacturing business. The strength has also continued into August, and is a part of a general movement embracing practically all industrial and railroad securities. Early in August, the average level reached about a par with the peak of last winter. The copper stocks, it will be noted, at last show indications of coming into their own after a year and a half's neglect. July's average was well above that of last winter, with every stock on the list of thirteen registering higher figures and Granby, Calumet & Arizona, Miami, Copper Range, Quincy, and Old Dominion particularly strong compared with June.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	134.38
Average 7 months, 1925	109.45
Average 7 months, 1926	108.66

	1925	1926
April	104.75	105.93
May	105.34	105.43
June	107.19	106.68
July	108.81	109.08

Among the seven larger companies, with more diversified interests, National Lead and U. S. Smelting were the only ones to decline. In this group, Anaconda showed particular strength; efforts to bull this stock have had plenty of ammunition, such as reports of phenomenal business on the part of American Brass, its lusty subsidiary.

In the miscellaneous group of thirteen gold-silver-lead-zinc companies, the market strength brought the average up to that of last January and February. No spectacular advances were made, and the declines were of small consequence.

Copper Reserves Decline

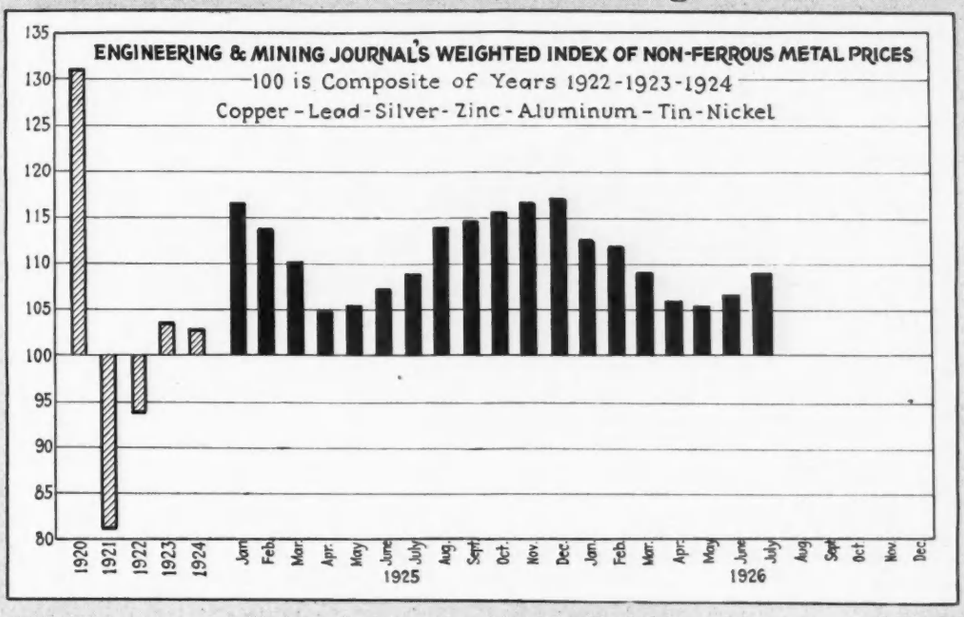
An important reason for the increasing strength of the copper market is the decline in stocks of blister and refined, a marked reduction having taken place in June, which brought the total to the lowest level of 1926 in spite of the fact that stocks on the first of June were the highest that they had been for a year. Domestic consumption has continued exceedingly large, though the average of daily shipments was not so great in June as in March. Many producers are entirely sold out of copper for early delivery, though efforts have been made to sell some special shapes, as witness wide offers of ingots by a Michigan producer. Foreign shipments continued disappointing, slight declines having occurred in both May and June. The strength of the copper market without European support is distinctly encouraging, for a little more buying from England, France, and Germany would almost certainly give increasing strength to the market here, and industrial conditions in the two countries last named seem on the mend; in England the coal strike cannot last forever. The export association, though not yet functioning as a corporate entity, has brought the various sellers together in discussing plans, and they seem less prone to bitter competition in the export market than heretofore. Foreign co-operation in the proposed association seems now definitely assured.

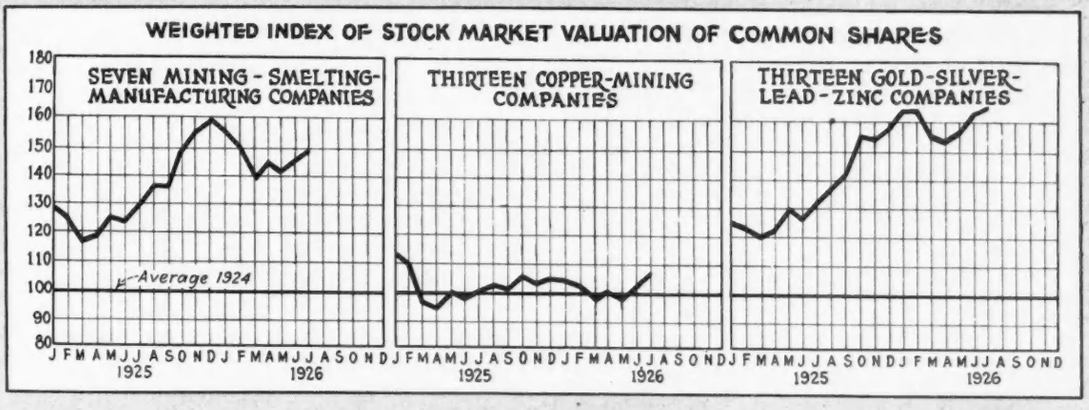
More forward buying is in evidence in the copper market, being caused partly by better forward orders that have been secured by manufacturers of copper products, which they are covering; and partly by a desire on their part to get copper as cheaply as possible and anticipate a further rise to 15c. or more per pound.

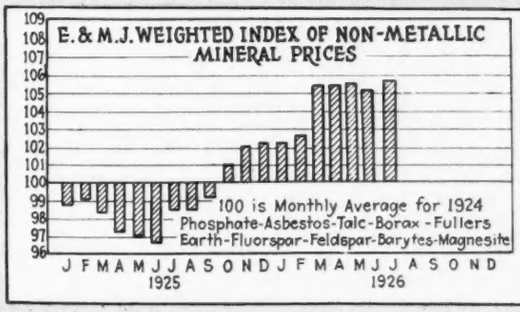
Domestic consumption of zinc continues excellent in spite of the bearish stories that the galvanizers relate to the would-be zinc sellers. Average daily consumption increased slightly in both May and June. The July figures were received too late to be included in the graph, but in that month a slight decline was noted, largely owing to the holiday. The average rate of production was almost exactly the same in July as in June, and about 100 tons per day below shipments. Thus stocks at the end of July were down to 22,986 tons, or less than a half month's supply, substantial reductions in stocks occurring in both June and July for the first time since last fall. Slab zinc exports increased slightly, these being, of course, "High-grade" or foreign ore metal, as it has not been possible to sell Prime Western in the foreign market to advantage for a long time. A marked drop in the tonnage of zinc concentrates exported in May and June is noted. This was caused by an increase in smelting tolls at European plants.

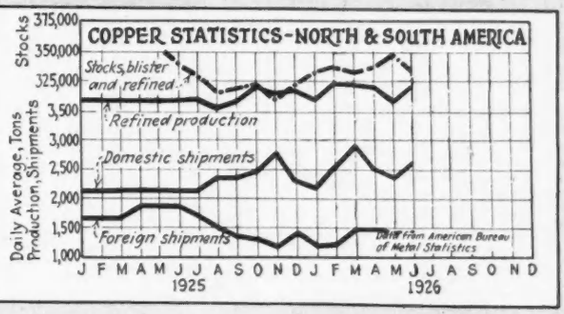
The only marked characteristic of the lead statistics is the continued and pronounced increase in smelter and refinery stocks. The latest figures available are those for the end of May, which was about the time lead prices reached their lowest levels, as can be seen from an inspection of the curve on the preceding page. Since then the market has been much stronger, with producers reporting a great dearth of metal for early shipment, so presumably the reserve stocks have decreased materially in the last two months.

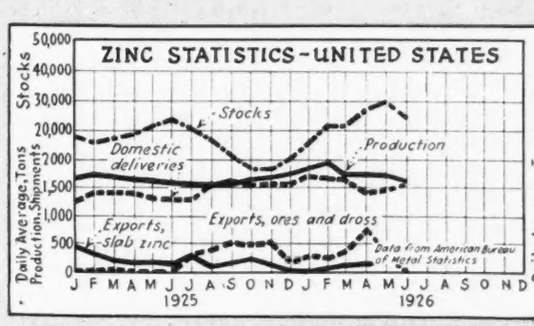
E.&M.J. Statistics of the Mining Industries

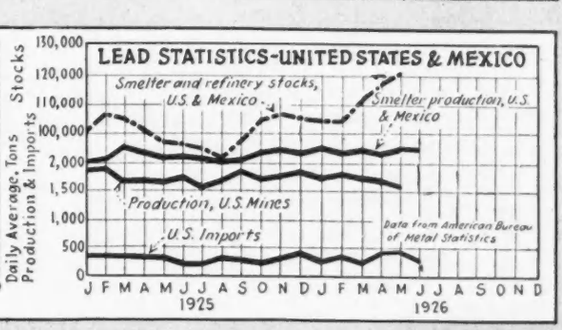

ENGINEERING & MINING JOURNAL'S WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is Composite of Years 1922-1923-1924
Copper - Lead - Silver - Zinc - Aluminum - Tin - Nickel
1925
1926




E. & M.J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate-Asbestos-Talc-Borax - Fullers Earth-Fluorspar-Feldspar-Barytes-Magnesite
1925
1926






LEAD STATISTICS - UNITED STATES & MEXICO
Stocks
Daily Average, Tons Production & Imports
Smelter and refinery stocks, U.S. & Mexico
Smelter production, U.S. & Mexico
Production, U.S. Mines
U.S. Imports
Data from American Bureau of Metal Statistics
1925
1926

Mining Stocks—Week Ended August 7, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	51⅞	49¾	51	Jy.17, Au.23	Q 0.75
Arcadian Consol.	Boston	1⅜	1⅛	1⅜		
Ariz. Com'l	Boston	12⅜	11⅜	12¼	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	....	....	1⅜		
Calumet & Arizona	New York	73	69½	71½	Jn. 4, Jn. 21	Q 1.50
Calumet & Hecla	Boston	18	15⅜	18	Jn. 1, Jn. 15	Q 0.50
Cerro de Pasco	New York	73	68½	72½	Jy. 15, Au. 2, Q	1.00
Chile Copper	New York	34⅜	33⅞	34⅜	Sept. 1, Sept. 27,	Q 0.62½
Chino	New York	22	22	22	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3½	3½	3½	....	....
Copper Range	Boston	19	17¾	19	May, 1925	1.00
Crystal Copper	Boston Curb	*41	*32	*37	....	....
East Butte	Boston	3⅜	3⅜	3⅜	Dec., 1919	0.50
First National	Boston Curb	*22	*20	*22	Feb., 1919	0.15
Franklin	Boston	*55	*40	*55	....	....
Granby Consol.	New York	24⅞	23½	24⅛	May, 1919	1.25
Greene-Cananea	New York	22½	20⅝	22	Nov., 1920	0.50
Hancock	Boston	....	....	*80	....	....
Howe Sound	New York	38⅞	37¾	38⅞	Ap.1, Ap.15	0.75
Inspiration Consl.	New York	25¾	25	25½	Jn.7, Jy.6, Q	0.50
Iron Cap	Boston Curb	4	3⅞	4	Jn. 1, Jn. 15	0.50
Isle Royale	Boston	13½	12⅜	13⅜	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	*75	*59	*59	....	....
Kennecott	New York	58⅞	56½	58⅝	Sept. 3, Oct. 1	Q 1.00
Lake Copper	Boston	1¼	1 1/16	1¼	June, 1925	0.50
Magma Copper	New York	42	41	41½	Jn.30, July.15,	Q 0.75
Mason Valley	N. Y. Curb	2½	1⅞	2⅛	....	....
Mass Consolidated	Boston	*50	*40	*40	Nov., 1917	1.00
Miami Copper	New York	15½	14½	15½	Aug. 2, Aug. 16	Q 0.25
Mohawk	Boston	42½	39½	42½	Jy.31, Se.1	Q 1.00
Mother Lode Coa.	New York	6½	6	6½	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	14½	13½	14½	Jn. 15, Jn. 30	Q 0.25
New Cornelia	Boston	24	22½	23	Au.6, Au.23	Q 0.04
North Butte	Boston	3	2½	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*60	*56	*58	No. 14, De. 2	0.05
Old Dominion	Boston	19	18	18½	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†126	†123	....	Jun.22, July2	Q 1.50
Quincy	Boston	24	23½	24	Mar., 1920	1.00
Ray Consolidated	New York	15	13⅜	15	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb	....	....	11⅞	....	....
St. Mary's Min. Ld.	Boston	33½	32	33½	Ap.17, My.18	2.00
Seneca Copper	New York	6½	5¾	6½	....	....
Shannon	Boston	*50	*50	*50	Nov., 1917	0.25
Superior & Boston	Boston	....	....	*75	....	....
Tenn. C. & C.	New York	12½	11⅜	12⅛	Au.31, Se.15	Q 0.25
United Verde Ex.	N. Y. Curb	28⅞	28	28⅜	Jy.17, Aug. 2,	0.75
Utah Copper	New York	104	104	104	Jn.15, Jn.31	Q 1.25
Utah Metal & T	Boston	1½	1⅜	1½	Dec., 1917	0.30
Victoria	Boston	*60	*60	*60	....	....
Walker Mining	Salt Lake	*110	*85	*85	....	....
NICKEL-COPPER						
Internat. Nickel	New York	38⅞	37	37⅝	Je.17, Je.30,	0.50
Internat. Nickel, pfd.	New York	....	....	104	Jy.12, Au.2,	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*28½	*28	*28	Jn. 10, Jy.10	0.01
National Lead	New York	161⅞	159¾	161½	Jn. 11, Jn. 30	Q 2.00
National Lead pfd.	New York	....	....	116¾	My.21, Je.15	Q 1.75
St. Joseph Lead	New York	43½	41½	43	Jn.10, Jn.21	QX 0.75
ZINC						
Am. Z. L. & S.	New York	7⅜	7⅜	7⅜	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	35½	35	35½	Nov., 1920	1.50
Butte C. & Z.	New York	5⅜	5	5	De.10, De.24	0.50
Butte & Superior	New York	11⅜	10⅜	11½	Jn.15, Jn.30	Q 0.50
Callahan Zn-Ld	New York	1⅜	1⅛	1⅛	Dec., 1920	0.50
Eagle Picher	Cincinnati	32⅜	31½	32⅛	Sept.10, Sept.30	Q 2.00
Eagle Picher, pfd.	Cincinnati	....	....	110	Aug.20, Sept.15	Q 1.75
New Jersey Zn.	N. Y. Curb	....	....	208	July20, Aug.10	Q 2.00
United Zinc	N. Y. Curb	....	....	*70	....	....
Yellow Pine	Los Angeles	....	....	*25	De.8, De.18	Q 0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛	....	....
Argonaut	Toronto	*21	*19½	*19½	....	....
Barry-Hollinger	Toronto	*51	*50	*51	....	....
Carson Hill	Boston	....	....	*22	....	....
Consol. W. Dome L.	Toronto	*16	*15	*15½	....	....
Cresson Consol. G.	N. Y. Curb	....	....	2⅜	Mh.31, Ap.10	0.10
Crown Reserve	Toronto	....	....	*9½	Jan., 1917	0.05
Dome Mines	New York	11¼	10⅛	11	Jn.30, July 20,	Q 0.50
Golden Center	N. Y. Curb	2⅜	2⅛	2⅛	....	....
Golden Cycle	Colo. Springs	....	....	1.52	No.30, Dec.10	Q 0.03
Hollinger Consol.	Toronto	19.65	19.50	19.50	Jy.27, Au.12	M 0.10
Homestake Mining	New York	55	54½	55	Au.20, Au.25	M 0.50
Kirkland Lake	Toronto	*96½	*93	*96½	....	....
Lake Shore	Toronto	12.15	12.05	12.10	Jn.1, Jn. 15	Q 0.10
McIntyre-Porcupine	New York	25⅜	24⅛	25⅛	Au.2, Se.1	Q 0.25
Newray	Toronto	....	....	*33	....	....
Noranda	N. Y. Curb	17⅜	16⅜	17⅜	....	....
Night Hawk Pen	Toronto	*7½	*7½	*7½	....	....
Portland	Colo. Springs	....	....	*43¼	July6, July15	0.02
Premier Paymaster	Toronto	....	....	2.16	....	....
Rand Mines	New York	35	35	35	Au. 11, Am. Shs.	6½s
Teck-Hughes	Toronto	3.90	3.85	3.86	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	*63	*55	*55	Ma.10, Ma.20	0.02
Tough-Oakes	Toronto	*39	*38½	*39	....	....
United Eastern	N. Y. Curb	*30	*30	*30	July, 1924	0.05
Vipond Cons.	Toronto	1.79	1.75	1.78	....	....
Wright-Hargreaves	Toronto	8.40	8.10	8.15	Jn.15, Jy.1	Q X 0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	21	....	....
GOLD AND SILVER						
Carnegie Metals	Boston	....	....	14	....	....
Con. Cortez	N. Y. Curb	*6	*6	*6	....	....
Con. Virginia	San Francisco	*7½	*5	*5	....	....
Continental Mines	N. Y. Curb	....	....	*45	....	....
Dolores Esperanza	N. Y. Curb	....	....	*40	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2 1/16	2⅛	Jn.18, Jy.3	Q 0.08
Tonopah Belmont	N. Y. Curb	3⅛	2⅝	2⅝	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*50	*50	*50	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	6½	5	5	Ap.7, Ap.21	Q 0.07½
Unity Gold	N. Y. Curb	....	....	*30	....	....
West End Consol.	N. Y. Curb	*17	*17	*17	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	....	....	*30	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	....	....	.1	Oct., 1920	0.50
Beaver Consol.	Toronto	*78	*75	*78	May. 1920	0.03
Castle-Trethewey	Toronto	1.54	1.51	1.54	....	....
Coniagas	Toronto	4.10	3.80	3.90	May, 1924	0.12½
Keeley	Toronto	1.67	1.65	1.66	Ma.1, Ma.15	X 0.12
Kerr Lake	N. Y. Curb	1	1	1	Ap.1, Ap.15	0.12½
La Rose	Toronto	*10½	*9⅞	*10⅜	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*91	*85	*91	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*14	*13½	*14	Oct., 1920	0.03
Mining Corp. Can.	Toronto	4.14	3.96	3.99	Jy.1, Jy.15	0.12½
Nipissing	N. Y. Curb	5½	5⅛	5⅜	Jn.30, Jy.20	0.15
Temiskaming	Toronto	50	50	50	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	8½	8	8	Jn.18, Jy.5,	Q X 0.25
Alta Merger	Salt Lake	†*5½	†*2½	....	....	....
Bingham Mines	Boston	35	31	35	Jn.19, Jn.30	Q 1.00
Cardiff M. & M.	Salt Lake	*44	*35	*37½	De.16, No.18	0.10
Chief Consol.	Salt Lake	3.10	3.00	3.00	Jy.10, Au 10	Q 0.10
Cleveland-Cliffs Iron	Cleveland	†*80½	†*80	....	....	....
Emma Silver	Salt Lake	†1	†*50	....	....	....
Erupcion	Boston Curb	1⅜	1 1/16	1⅛	Jn.18, Jy.5,	QX 0.10
Federal M. & S.	New York	81	81	81	....	....
Federal M. & S., pfd.	New York	79	72½	76⅛	My.25, Ju.15	Q 1.75
Hawthorne Mines	N. Y. Curb	*15	*13	*13	....	....
Hecla Mining	N. Y. Curb	18	17⅜	18	My.15, Je.15	Q 0.50
Iron King Mining	Salt Lake	*22	*20	*20	....	....
Keystone Mining	Salt Lake	†*42	†*26	....	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*16	*15½	*15½	....	....
Lucky-Tiger Combination	Kansas	....	....	*9.25	Au.10, Au.20	X 0.07
Mammoth Mining	Salt Lake	2.80	2.75	2.80	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	2.75	2.50	2.75	Se.15, Oc.1	0.15
Park Utah	New York	7.15	6.75	6.75	Jn.15, Jy.1	Q 0.15
Plutus Mining	Salt Lake	1.75	1.70	1.75	July 15	0.10
Prince Cons.	Salt Lake	....	....	1	....	....
Silver King Coal	Salt Lake	9.10	9.00	9.00	Jn. 21, July 1,	Q 0.25
Silversmith	Spokane	*48	*47	*48	Jn.30, Jy.10	Q 0.02
Tamarack-Custer	Spokane	*29½	*29	*29	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.50	13.37½	13.37½	Jn.16, Jn.26,	0.40
Utah-Apex	Boston	8	7½	7½	Jy. 3, Jy.15	Q 0.25
Western Utah Copper	N. Y. Curb	....	....	*8	....	....
IRON						
Bethlehem Steel	New York	49⅜	45½	49½	July, 1924	1.25
Colorado Fuel & Iron	New York	47¾	44⅜	46½	May, 1921	0.75
Gt. North'n Iron Ore	New York	....	....	19⅜	De. 4, De. 28,	0.75
Inland Steel	New York	43	41	43	Au.13, Se.1	Q 0.62½
Mesabi Iron	N. Y. Curb	....	....	1⅜	....	....
Replogle Steel	New York	10½	9⅜	9⅜	....	....
Republic I. & S.	New York	63⅜	58⅜	62⅜	Au.14, Se.1	1.00
Republic I. & S. pfd.	New York	97⅞	97	97⅜	Se.15, Oc.1	Q 1.75
Sloss-Sheffield S. & I.	New York	133	130	130	Jn.10, Jn.21	Q 1.50
Sloss-Shef. S.&I. pfd.	New York	107⅞	107⅞	107⅞	Jn.21, July.1,	Q 1.75
U. S. Steel	New York	153⅜	146⅜	151⅛	Se.2, Se.29	Q 1.75
U. S. Steel pfd	New York	129½	128	128½	Au.3, Au.30,	Q 1.75
Virginia I. C. & C.	New York	....	....	43	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	....	....	70	Jn.1, July 2,	2.50
ALUMINUM						
Alum. Co. of Amer.	N.Y. Curb	69⅛	68⅛	68⅛	....	....
Alum. Co. of Amer pf.	N.Y. Curb	....	....	101½	June 15, July 1,	Q 1.50
VANADIUM						
Vanadium Corp.	New York	36⅜	35¾	36¼	Au.2, Au.16,	Q 0.75
ASBESTOS						
Asbestos Corp., New	Montreal	17⅛	16¼	17⅛	De.31, Ja.15	Q 1.50
Asbestos Corp., pfd.	Montreal	71	66	69	Jy.1, Jy.15,	Q 1.75
SULPHUR						
Freeport Texas	New York	32½	29⅞	30⅜	Nov., 1919	1.00
Texas Gulf	New York	173	163⅛	169⅜	Jn.1, Jn. 15,	Q 2.50
DIAMONDS						
De Beers Consol.	New York	35½	35½	35½	Ju.16, Ju.17	1.70
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	5½	5	5	....	....
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	53¾	53	53¼	Au.20, Se.1,	Q 1.00
Amer. Metal pfd	New York	....	....	117	Au.21, Se.1	Q 1.75
Amer. Sm. & Ref.	New York	140½	133½	138⅜	Jy.10, Au.2,	Q 1.75
Amer. Sm.&Ref.pfd.	New York	120	120	120	Au.7, Se.1,	Q 1.75
Consol. M. & S.	N. Y. Curb	2.20	2.20	2.20	Jn.30, Jy.5	QX 3.75
Federated Metals	N. Y. Curb	12½	12½	12½	....	....
Newmont Mining	N. Y. Curb	68	66½	67½	Mar.31, Apr.15,	0.60
Southwest Metals	N. Y. Curb	....	....	1	....	....
U. S. Sm. R. & M.	New York	41⅛	38¼	38½	Jy. 7, Jy. 15,	Q 0.87½
U. S. Sm. R.&M.pfd.	New York	49½	49	49	Jy. 7, Jy. 15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED JULY 27, 1926

Name	High	Low	Last	Last Divd. Date	Amoun
Aramayo Mines (25 frs.)	81/3	79/4½	78/9	May. 1926	5 p.c.†
British Platinum (£1)	5/6	4/9	5/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	16/4½	15/10½	16/3	Aug. 1926	7 annas*
Bwana M'Kubwa (5s)	7/9	7/6	7/6	....	....
Camp Bird (2s)	4/2½	4/—	4/—	....	....
El Oro (£1)	9/—	8/0⅞	8/10½	Nov. 1924	2½ p.c.*
Esperanza (10s)	1/—	10½d	....	....	....
Frontino & Bolivia (£1)	7/7½	5/—	6/3	July 1926	2½ p.c.
Mexican Corpn. (£1)	16/—	15/9	15/9	Dec. 1925	12½ p.c.*
Mexico Mines of El Oro (£1)	25/—	24/0⅜	25/—	June 1926	7½ p.c.*
Oroville Dredging (£1)	4/—	4/—	3/9	Dec. 1923	3⅜ p.c.
Ouro Preto (£1)	2/1½	2/1½	2/1½	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	120/—	115/—	117/6	....	....
St. John del Rey (£1)	8/9½	8/1½	8/9	June 1925	6½ p.c.
San Francisco Mines (10s)	30/1¼	29/6	30/—	June 1926	15 p.c.
Santa Gertrudis (£1)	18/9	18/4½	18/9	July 1926	5 p.c.
Selukwe (2s. 6d.)	13/7½	12/9	13/3	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	4/6	4/3	4/4½	Nov. 1917	75 p.c.
Tanganyika (£1)	41/7	37/6	40/7½	Sept. 1925	5 p.c.
Tomboy (£1)	4/1½	3/9	3/9	July 1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.500	9.000	9.500	July 1926	175 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.